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

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ABSTRACT

Objectives: To compare congenital anomalies in infants born to diabetic and non-diabetic mothers, and to study the association of maternal age, parity, socioeconomic status and fetal sex with congenital anomalies

Material and Methods: This case control study was carried out on diabetic and non-diabetic mothers and their babies from January 2016 to June 2016. A total number of 100 diabetic and 100 nondiabetic healthy pregnant mothers were selected for this study. A detailed antenatal and maternal history including the mother's age, parity, mode of delivery and socioeconomic status were noted on an observation sheet. The data was analyzed with help SPSS version 20. A p-value ≤ 0.05 was considered significant.

Results: Infants of diabetic mothers had a significantly higher incidence of congenital anomalies (03% vs 14%, p value =0.005). Major congenital anomalies were significantly more common in babies of diabetic mothers as compared to those of non-diabetic mothers (64% VS 33%, p - value = 0.009). No significant difference was found between the mean age (25.85+ 5.242 vs 28.74+5.014 VS, p value = 0.690) and parity (p value =0.83) of the diabetic and non-diabetic mothers. . Congenital anomalies were significantly more common (23.8% vs 6.9% P value.006) in male infants as compared to female infants of diabetic mothers.

Conclusion: As compared to those of non-diabetic mothers, infants of diabetic mothers had a significantly higher incidence of congenital anomalies. This could probably be due to deranged metabolism of carbohydrates, proteins and fats.

Key Words: Congenital anomalies, Infants of diabetic mothers, Parity, Socioeconomic status, caesarean section, instrumental delivery, central nervous system, cardiovascular system, musculoskeletal system.

INTRODUCTION

Congenital anomalies are anatomical and functional defects occurring during intra uterine period. All over the world, CA cause an estimated 303,000 infants deaths with in first month per year. CA may contribute to lifelong disability which may cause serious impacts on the life of the individual, families, societies and health care system of the country. Some known risk factors for CA are genetic, demographic, socioeconomic, maternal health and nutritional status, and infections. Therefore, some CA can be prevented or minimized by vaccination, and by improving maternal health, nutrition and anti-natal care.[1]

Poor glycemic control during organogenesis is directly associated with higher risk for congenital abnormalities in IDMs.The risk for congenital defects IDMs is four times more common than in the general population[2]. Hyperglycemia can be teratogenic by directly effecting the yolk sac development and interfering with free radical functioning.[3,4]

Hyperglycemia during pregnancy can affect the growing fetus adversely and produce birth defect.[5] Pregestational 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 nephropathy and retinopathy or the course of these complications may be accelerated.[6,7]

In diabetic mothers, faulty carbohydrate, protein, and fat metabolism also occur in the embryo and adversely affect organ development. Congenital anomalies are directly related to diabetic control in the 3 months before conception and during the first 2 months of pregnancy as indicated by glycosylated hemoglobin levels.[8]

Maternal Diabetes can affect any developing organ and system of the embryo including the Central

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nervous system (Anencephaly, microcephaly, spina bifida and holoprosencephaly) Cardiovascular system (Ventricular septal defects, atrial septal defects, transposition of the great vessels, cardiomyopathy and, coarctation of the aorta) Musculoskeletal system (limb defects, sacral agenesis, and caudal regression syndrome), Renal system(hydronephrosis, ureteric abnormalities and renal agenesis) and Gastro intestinal system(anorectal atresia, small left colon syndrome and duodenal atresia). [9,10]

Socioeconomic status has been an established risk factor for a variety of fetal and maternal outcomes such as low birth weight, perinatal, neonatal and post-natal mortalities.[11-13] A large number of studies have shown association between lower social class and anomalies such as oral clefts, hypospadias, congenital cataracts, defects in limbs, cardiovascular and genitourinary systems. also, syndactyly, polydactyly, and hydrocephalus.[14-18] The extent and the presence or absence of socioeconomic inequalities in relation to CA may be an important etiological as well as determining factor in the investigations of environmental risk factors.

Previous studies have shown that apart from other influences, maternal intrinsic factors such as age and parity may also be responsible for some fetal congenital anomalies.[19-21] However their results were usually uneven due to limited sample size and differences in methodologies.

Many studies have reported male sex as independent risk factor for CA. It has been suggested that female newborns have an advantage over males in terms of better pregnancy outcomes[22]. As compared to female, male sex is associated with greater risk of system specific CA. This association between male sex and CA is independent of the social, demographic, and maternal factors.[23]

MATERIALS AND METHODS

This case control study was carried out on diabetic and non-diabetic mothers and their babies at obstetric and Gynae Unit Hayatabad Medical Complex Peshawar in association with Anatomy Department Khyber Girls Medical College Peshawar from January 2016 to June 2016. A total number of 100 diabetic and 100 nondiabetic healthy pregnant mothers were selected for this study. The mother having other chronic diseases, twin pregnancies and unwilling to participate were excluded from this study. A detailed antenatal and maternal history of the mother including the mother's age, parity, mode of delivery and socioeconomic status were noted on an observation sheet. Socioeconomic status was determined as poor or affluent based on family income, the level of education and occupational prestige.

After delivery, the weight and sex of the babies born to diabetic as well as nondiabetic mothers were noted. Diagnosis of congenital anomalies was based on clinical examination of newborn babies by the gynecologist and the pediatrician and through appropriate investigations such as ultrasonography, echocardiography etc. System wise distribution of the anomalies was performed.

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 newborns were studied. Characteristics of the mothers in both the groups are summarized in table 1. Characteristics of the newborns for both these groups are summarized in the tables 2 to 5.

No significant difference was found between the mean age (25.85+ 5.242 vs 28.74+5.014 VS, p value = 0.690) and parity (p value =0.83) of the diabetic and non-diabetic mothers as shown in table 1.

Compared to infants of non-diabetic mothers, those of diabetic mothers had a significantly higher incidence of congenital anomalies (03% vs 14%, p value =0.005). Major congenital anomalies were significantly more common in babies of diabetic mothers as compared to those of non-diabetic mothers (64% VS 33%, p - value = 0.009) as shown in table 2.

Congenital abnormalities were detected in almost every major system of the body. Majority of the CAs in infants of non-diabetic mothers were detected in the musculoskeletal system, constituting 66.66% Of the total, followed by urogenital system (33. 33%).No multiple systems anomalies were detected in infants of non-diabetic group. In IDMs Central nervous system (35.7%) and cardiovascular system (28. 58%)were the commonly involved systems. The other systems involved being musculoskeletal system (14.28%) and craniofacial system (7.16%). Multiple system anomalies were detected in 14.28% of the cases. Table 3

In both the groups congenital anomalies were significantly more common (13% vs 5.7% p value = .011) in infants born to mothers having poor socioeconomic status as compared to those with affluent class. Table 4.

Congenital anomalies were significantly more common (23.8% vs 6.9% P value.006) in male infants as compared to female infants of diabetic mothers. No significant difference (4.2% VS 1.9, P value .211) was

Table 1: Characteristics of the newborns in both the groups

	Type of mothers		P - value
	Non – diabetic n = 100	Diabetic n = 100	
Congenital anomalies	03 (03%)	14 (14%)	0.005*
Major Congenital anomalies	01 (33.3%)	09 (64.3%)	0.009*

Table 2: Characteristics of the mothers in both the groups

	Non – diabetic n = 100	Diabetic n = 100	P-value
Maternal age	28.74+5.014	25.85+ 5.242	0.690
Parity			
Primigravida (0)	25	36	
Multigravida (2-3)	60	57	
Grand multigravida (Above 4)	15	07	0.83

Table 3: System wise incidence of CAs in 14 cases of IDMS

S.no	System involved	No of cases	% age
1	CNS	5	35.70%
2	CVS	4	28.58%
3	Musculoskeletal	2	14.28%
4	Multiple systems	2	14.28%
5	Craniofacial	1	7.16%
System wise incidence of CA in 03 cases of infants of non-diabetic mothers			
1	Musculoskeletal	2	66.67%
2	Urogenital	1	33.33%

Table 4: Socioeconomic status of mothers in both the groups

Socioeconomic status of mothers	Type of mother	Congenital anomalies		P - value
		Absent	Present	
Affluent	Non-Diabetic	36 (97.3%)	1 (2.7%)	.265
	Diabetic	30 (90.9%)	3 (9.1%)	
	Total	66 (49.3 %)	4 (5.7%)	
Poor	Non-Diabetic	61 (96.8%)	2 (3.2%)	.011
	Diabetic	56 (83.6%)	11 (16.4%)	
	Total	117(90.0%)	13(10%)	

Table 5: Male to Female ratio in congenital anomalies

Gender of newborn	Type of mother	Congenital anomalies		P - value
		Absent	Present	
Male	Non-Diabetic	46 (95.8%)	2 (4.2%)	.265
	Diabetic	32 (76.2%)	10 (23.8%)	
	Total	78 (86.7 %)	12 (13.3%)	
Female	Non-Diabetic	51 (98.1%)	1 (1.9%)	.011
	Diabetic	54 (93.1%)	4 (6.9%)	
	Total	105(95.5%)	05(4.5%)	

found in congenital anomalies between male and female infants of non-diabetic mothers, Table 5.

DISCUSSION

Congenital anomalies

Congenital anomalies were significantly higher (P =0.005) in infants born to diabetic mothers (14%) as compared to those of non-diabetic mothers (03%). Inge M Evers and his colleagues in his study has reported that, the rates of caesarean section, maternal mortality, congenital malformations and macrosomia were considerably higher in diabetic women than in the general population. [24]

Major congenital anomalies were also significantly higher (P = 0.009) in infants of diabetic mothers as compared to those of non-diabetic mothers (64% VS 33%). This may be due the fact that most of these diabetic mothers had poor glycemic control before and during pregnancy. Dorte M. Jensen and colleagues in a large nationwide study has stated that "pregnancies in women with type 1 diabetes are still complicated by increased rates of perinatal complications as compared to normal population and women having poor self-care are at comparatively higher risk."[25]The incidence of CAs is higher in uncontrolled diabetes with no preconception care than controlled case with good preconception care. J. G. Ray and his colleagues has mentioned the same fact in their article by stating "the rate of major anomalies was lower in women with pre-conception care than those without care."[26] Rosemary and her colleagues stated that 'preconception care resulted in significant decrease in poor pregnancy outcomes i.e. birth defects. Fetal deaths and still births".[27]

System wise distribution of CAs

Majority of the CAs in infants of non-diabetic mothers were detected in two main systems i.e. musculoskeletal system (66%) and the urogenital system (33. 33%).No multiple systems anomalies were detected in infants of non-diabetic group. A study conducted on general population in district Peshawar by Hamid et al has reported a 3.6% incidence of CA with the musculoskeletal being the most commonly affected system.[28]

In IDMs, CNS (35.7%) and CVS (28. 58%) were the commonly involved systems. The other systems involved being musculoskeletal system (14.28%) and craniofacial system (7.16%). Multiple system anomalies were detected in 14.28% of the cases. Macintosh in a large population-based study has reported a significant (P < 0.001) involvement of the central nervous and cardiovascular systems in infants born to mothers with pre-gestational diabetes.[29]

Age and parity of mothers

There was non-significant difference (p =0.690) between parity, and the average age of diabetic (25.85+ 5.242) and non-diabetic mothers (28.74+5.014). 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.[30]

Male predominance in newborns with CAs

In our study male newborns were significantly (P =.006) more affected by congenital anomalies in IDMs, as compared to female infants. However, no significant difference (P = 0.211) was found in congenital anomalies between male and female infants of non-diabetic mothers, the reason being males are less resistant to oxidative stresses and more susceptible to develop birth defects. Sokal and his colleagues in a nationwide study in the UK has reported the overall risk of any CA being 26% greater in males than in females. Compared to females, the risk of multiple CAs in males to be even greater than that of a single anomaly.[31]

Socioeconomic status of mothers

In both the groups congenital anomalies were significantly more common (13% vs 5.7% p value = .011) in infants born to mothers having poor socioeconomic status as compared to those with affluent class. The CAs are more common in low socioeconomic group (p value = .011) as compared to affluent class in both diabetic as well as non-diabetic group. Majority of studies are in favor of our findings including a study conducted on 8671 pregnancies in which high social status at enrolment was associated with a lower recurrence rate of CAs and rise in social status between the 2 births was marginally associated with a decline in the recurrence risk.[32] Similarly, mothers with low socioeconomic class leading stressful life around the time of conception or early gestation may be at high risk of delivering infants with Cas.[33] Laharwal and his colleagues in a study conducted in Kashmir valley has also reported a direct relationship between the neural tube defects (NTDS) and maternal socioeconomic status.[34]

CONCLUSION

As compared to those of non-diabetic mothers, IDMs had a significantly higher incidence of congenital anomalies. CAs were significantly more common in infants born to mothers having poor socioeconomic status as compared to those with affluent class in both the groups,this may be due to poor nutritional and educational status in these women. Congenital anomalies were significantly more common in male infants as compared to female infants of diabetic mothers as male infants are less resistant to oxidative stresses as compared to female infants.

RECOMMENDATIONS

1. Maternal diabetes should be screened and treated before and during pregnancy to improve maternal and neonatal outcomes.
2. Low socioeconomic status is an additional risk factors for congenital anomalies due to associated low nutritional, education and health status in these women.
3. Pediatrician and obstetrician should be aware of the neonatal and maternal risks associated with diabetes in pregnancy especially congenital anomalies and other complications.
4. Most of the congenital anomalies can be detected through a regular antenatal ultrasonic scan which will help in early detection and selective termination of pregnancies with serious anomalies.
5. Diabetes is a very common medical problem in our country, all government and non-governmental organizations, religious scholars and health professionals should play an active role in educating public regarding course, treatment, self-care and complications of this disease. Print, electronic, and social media must play their vital role in this regard.

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