

Frequency of Congenital Cardiac Conditions in Children Born to Diabetic Moms

HAMID IQBAL¹, SAEED UR REHMAN², ABDURRAZQAQ³, ALI ABBAS KHAN⁴, MAZHAR ALI⁵, FAWAD UL HAQ⁶

¹Medical Officer Ayub Teaching Hospital Abbottabad.

²Medical Officer Mufti Mehmood Teaching Hospital Dera Ismail Khan

³Medical Officer Category D Hospital Munda Dir Lower Kpk

⁴Medical Officer Mufti Mehmood Teaching Hospital Dera Ismail Khan

⁵Junior Consultant Shifa Foundation Islamabad.

⁶Trainee Registrar Mufti Mehmood Teaching Hospital Dera Ismail Khan

Corresponding author: Saeed Ur Rehman, Email: saeedurrehman347@gmail.com

ABSTRACT

Introduction: The foetal cardiovascular system is teratogenically affected by maternal diabetes. Because of this, cardiovascular abnormalities are the most prevalent anomaly in children of diabetes moms. Despite improvements in the medical care provided during pregnancy to diabetic mothers, a cardiac complication in their infants is still more frequent than in infants of the general population.

Objectives: to quantify the prevalence of congenital cardiac problems in offspring of diabetes moms.

Materials & Methods: this-Cross-sectional-study conducted in the Departments of Paediatrics and Neonatology, Ayub Medical College and Hospital, Abbottabad . from Jan 7 2021, to Jun 6 2021. A total of 111 full-term neonates born to diabetic mothers were included. Premature babies and other congenital anomalies were excluded. After taking consent and detailed history, all the neonates included in the study were sent for (Echocardiography) at the cardiac division of Abbottabad's Ayub Teaching Hospital. In the same department, echocardiography was conducted by the same cardiologist. Neonatal congenital heart disease was treated in hospitals.

Results: Mean age was 3.35 ± 1.29 days (Table I). The mean maternal age was 38.64 ± 1.37 weeks. Out of the 111 patients, 79 (71.17%) were male, and Females made up 32 (28.19%), with a male-to-female ratio of 2.5:1. The average newborn weighed 3.93 1.62 kg. In this research, I discovered that 43 (38.74%) children with a mother who has diabetes had congenital cardiac disease.

Conclusion: This study has shown the prevalence of congenital cardiac abnormalities, with patent ductus arteriosus being the most prevalent abnormality among children born to diabetic moms.

Keywords: congenital heart defects, diabetic mothers, patent ductus arteriosus.

Births in the US, whereas just 2% of pregnancies in Faisalabad have diabetes. Teratogenic

INTRODUCTION

Diabetes affects 4/1000 pregnancies in the UK and 2.6% of all live effects of maternal hyperglycemia on the foetal cardiovascular system¹. Cardiovascular abnormalities are the most prevalent in diabetic moms' babies. Despite improved prenatal care for diabetes women, their babies still have more significant cardiac complications than the general population.² Poor diabetes management during pregnancy may cause newborn problems, although excellent diabetes treatment can prevent most.³ Maternal glucose regulation is abnormal in 3–10% of pregnancies. Infants of diabetic mothers (IDMs) continue to be at risk for congenital heart and central nervous system defects, preterm delivery, macrosomia, asphyxia, respiratory distress, hypocalcemia, hypoglycemia, hyperbilirubinemia, polycythemia hyperviscosity, and hypertrophic cardiomyopathy despite advancements in perinatal care.⁴ CHD prevalence was five times higher in babies with diabetes moms than in those with healthy mothers. 8. 7.6% of diabetic moms' babies had congenital malformations.⁵ One Peshawar research identified 4.7 CHD cases in IDM CHD frequency is 1.8%, according to Isra University. In another research, diabetes moms' babies had a 17.3% risk compared to 8.5% for non-diabetics. 6 Research revealed 47.3% of diabetes mothers' babies had congenital cardiac disease.¹³ Another research found 24.44% of diabetes moms' babies had congenital cardiac abnormalities.⁷ PDA, VSD, ASD, PFO, and TGA were found in 16.8%, 12.9%, 8.9%, 7.9%, and 5.9%, respectively. Ferdousi et al. observed PDA in 55.3%, Patent Foramen Ovale in 60.71%, Hypertrophic Cardio Myopathy in 21.42%, ASD in 10.71%, and VSD in 3.54%. Savas et al.⁸ discovered that 38% of patients had hypertrophic cardiomyopathy, 70% had PDA, 68% had PFO, 5% had ASD, and 4% had VSD. Islam et al.⁹ identified 6% TOF in IDM. Preventing congenital cardiac abnormalities requires prenatal euglycemia. The research found that children born to diabetes mothers had 3.2 times the risk of structural heart problems than those born to non-diabetics. The most common cardiac malformations are transposition of the major arteries, double outlet right ventricle,

truncus arteriosus, hypoplastic left heart syndrome, and ventricular septum anomalies.¹⁰ Previous studies show diabetic moms' babies often have congenital cardiac problems. Multiple studies have been done nationally and worldwide, but none have been done locally. The research aims to quantify the local burden of congenital cardiac disease in newborns of diabetes moms. Results of this research for early diagnosis and therapy of congenital heart disease in diabetes moms' newborns.¹¹

MATERIALS & METHODS

A a-Cross-sectional-study conducted in the Departments of Paediatrics and Neonatology, Ayub Medical College and Hospital, Abbottabad . from Jan 7 2021, to Jun 6 2021. A total of 111 full-term neonates born to diabetic mothers were included. Premature babies and other congenital anomalies were excluded. After taking consent and detailed history, all the neonates included in the study were sent for (Echocardiography) at the cardiac division of Abbottabad's Ayub Teaching Hospital. The same cardiologist performed (echocardiography) in the same department. Hospital procedures treated congenital cardiac disease in neonates. SAMPLE SIZE: 111 patients, CL=95% Anticipated population proportion 24.44%¹⁴, Absolute precision =8% SAMPLE TECHNIQUE: Non-probability, consecutive sampling.

Inclusion Criteria: All full-term neonates are born to diabetic mothers.

Exclusion Criteria:

1. Premature babies
2. Neonates having other congenital anomalies (syndromic babies)
3. Mother having any disease other than diabetes.
4. Mother using any medication other than insulin or antidiabetic drugs.

Collecting Data: After receiving permission from the hospital's ethics committee, all full-term neonates born to diabetic mothers were enrolled in the study; after taking consent and detailed history, all the neonates included in the survey were sent for

(Echocardiography) to the department of cardiology, Ayub teaching hospital, Abbottabad. (Echocardiography) was done in the same department by the same cardiologist. Neonates having congenital heart disease were managed as per hospital protocol. All the data was noted in proforma designed by the trainee.

Statically Analysis: SPSS v.20 was used to analyse all of the data. Age, gestational age at delivery, and birth weight are quantitative variables quantified as mean and standard deviation. Congenital cardiac disorders and gender were qualitative variables calculated as frequencies and percentages. The mother's age upon delivery and birth weight were stratified. The chi-square test was used after the stratification of CHD at P 0.05.

RESULTS

The mean age was 3.35 ± 1.29 days (Table I). The mean maternal age was 38.64 ± 1.37 weeks (Table II). Out of the 111 patients, 79 (71.17%) were male, and 32 (28.29%) were females, with male to female ratio of 2.5:1 (Figure 1). Mean birth weight was 3.93 ± 1.62 kg (Table III).

In this study, I have found the frequency of congenital heart disease in infants of diabetic mothers as 43 (38.74%), as shown in Figure II. The frequency of different types of genetic heart diseases in infants born to diabetic mothers is shown in Table IV. Stratification of congenital heart defects concerning age and GA is shown in Table V & VI, respectively. Tables VII & VIII have shown the stratification of congenital heart defects relating to gender and birth weight, respectively.

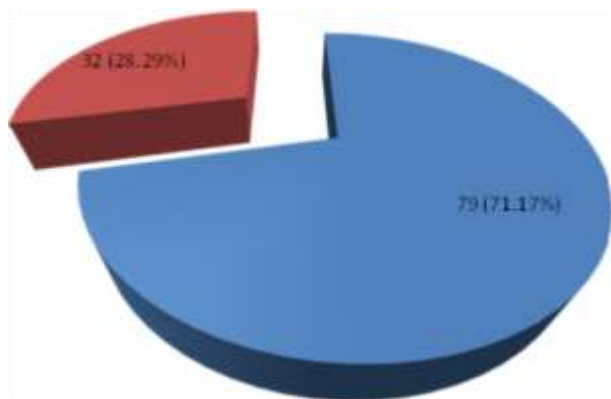


Figure-1: Distribution of patients according to gender (n=111).

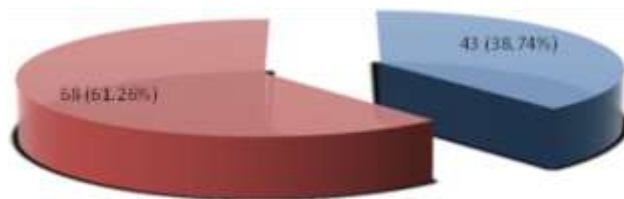


Figure 2: Frequency of congenital heart disease in neonates born to diabetic mothers (n=111).

Table-1: Age distribution of patients (n=111).

Age (in days)	No. of Patients	%age
≤3	56	50.45
>3	55	49.55
Total	111	100.0

Mean ± SD = 3.35 ± 1.29 days

Table 2: Distribution of patients according to gestational age (n=111).

GA at delivery (weeks)	No. of Patients	%age
37-39	79	71.17
40-42	32	28.83
Total	111	100.0

Mean ± SD = 38.64 ± 1.37 weeks

Table 3: Distribution of patients according to birth weight (n=111).

Birth weight (kg)	No. of Patients	%age
≤5	75	67.57
>5	36	32.43
Total	111	100.0

Mean ± SD = 3.93 ± 1.62 kg

Table 4: Congenital heart disease prevalence in children born to diabetes moms

Congenital heart defects	Frequency	Percentage
Patent ductus arteriosus (PDA)	17	39.53
Atrial septal defect (ASD)	06	13.95
Ventricular septal defect (VSD)	04	9.30
(Tetralogy of Fallot) (TOF)	08	18.60
(Transposition of great arteries)(TGA)	07	16.28
Truncus arteriosus (TA)	01	2.32

Table 5: Stratification of congenital heart disease concerning age groups.

Age (days)	Congenital heart disease		p-value
	Yes	No	
≤3	19 (33.93%)	37 (66.07%)	0.294
>3	24 (43.64%)	31 (56.36%)	

Table 6: Stratification of congenital heart disease concerning GA.

GA (weeks)	Congenital heart disease		p-value
	Yes	No	
37-39	25 (31.65%)	54 (68.35%)	0.016
40-42	18 (56.25%)	14 (43.75%)	

Table 7: Stratification of congenital heart disease concerning gender.

Gender	Congenital heart disease		p-value
	Yes	No	
Male	33 (41.77%)	46 (58.23%)	0.303
Female	10 (31.25%)	22 (68.75%)	

Table 8: Stratification of congenital heart disease concerning birth weight.

Birth weight (kg)	Congenital heart disease		p-value
	Yes	No	
≤5	29 (38.67%)	46 (61.33%)	0.982
>5	14 (38.89%)	22 (61.11%)	

DISCUSSION

Diabetic moms (IDM) increase the chance of congenital abnormalities by 2.5 to 12%, with genetic heart problems being overrepresented.¹¹ The most prominent rate of deformities is among moms on insulin during conception.¹² IDMs commonly have respiratory difficulties that must be distinguished from their cardiovascular abnormalities (structural congenital heart abnormality and hypertrophic cardiomyopathy) and cardiovascular maladaptation to extra-uterine life.^{13,14} This research examined the prevalence of congenital cardiac disease in diabetes moms' babies. I identified 43 (38.74%) diabetic mother babies with congenital cardiac disease in this investigation. 7.6% of diabetic moms' babies had congenital malformations.¹⁵ One research in Peshawar identified 4.7 CHD cases in IDM. 10 IDM CHD frequency is 1.8%, according to Isra University.¹⁶ Another research found a 17.3% risk for diabetes moms' babies vs 8.5% for non-diabetics. 17 research revealed 47.3% of diabetes mothers' babies had congenital cardiac disease.¹⁸ Another research found 24.44% of diabetes moms' babies had congenital cardiac abnormalities.¹⁴ A study⁶² investigated 100 consecutive IDMs. The most common echocardiographic findings were PDA (70%), patent foramen ovale (68%), atrial septal defect (5%), mild muscular ventricular septal defect (4%), mitral valve prolapse (2%), and pulmonary stenosis (1%).¹⁸ The interventricular septum was hypertrophied in 38% of patients with hypertrophic cardiomyopathy (HCMP). D-transposition of great arteries, tetralogy of Fallot, and hypoplastic left heart syndrome (1% each) were severe CHDs.¹⁹ No isolated aortic stenosis or coarctation was seen in this series. Congenital cardiac disease was 15% without PDA and HCMP.²⁰ The specific mechanism that causes CHD in any kind of DM is complex and unknown. Diabetes embryopathy is complicated and impacted by

metabolic signalling, cell signalling, maternal and foetal genotypes, environmental variables, and uncontrolled hyperglycemia, according to animal studies.²¹ This last metabolic stage impacts the equilibrium of the foetal metabolic and circulatory systems. This results in a hypoxemic environment that may lead to severe CHD in the first trimester of pregnancy. In non-diabetic pregnancies, maternal physiological changes enhance maternal insulin resistance, ensuring foetal growth and development.²² These adaptations may be made worse by maternal glucose intolerance, altered glucose metabolism, cortisol/growth hormone levels, reduced physical activity, and increased calorific intake during pregnancy. During the second or third trimester, GDM develops. has been related to a rise in perinatal morbidity and mortality; however, pregestational diabetes is more closely connected to foetal anomalies than gestational diabetes.²³ In GDM-complicated pregnancies, CHD may be caused by hyperglycemia, insulin resistance, a higher BMI, and—most crucially—undiagnosed pre-gestational diabetes.⁶⁴ The most recent study by Hunter et al. discovered a 26.7% risk of a concurrent cardiac anomaly and a 2.76% incidence of CHD in GDM pregnancies. Similar to IDDM pregnancies, 3.1% of CHD cases and 25% of other cardiac anomalies were present simultaneously.²⁴ Similar to Lisowski's 2010 comprehensive multi-centre retrospective clinical assessment, literature review, and meta-analysis, CHD has an incidence of 3.6% and has the same morphological features.²⁵ These findings demonstrate that all DM types may cause a wide range of CHD. Nearly all CHD forms have conotruncal anomalies, which are more common. IDDM hyperglycemia is harder to treat medically than DM type II or GDM, which may explain the slight variation in CHD incidence.²⁶ The most recent Hunter et al. research found a 2.76% incidence of CHD in GDM pregnancies and a 26.7% probability of a concurrent cardiac abnormality. Similar to IDDM pregnancies, 3.1% had any CHD, and 25% had concurrent additional cardiac abnormalities.²⁷ These findings demonstrate that all DM types may cause a wide range of CHD. Nearly all CHD forms have conotruncal anomalies, which are more common. IDDM hyperglycemia is harder to treat medically than DM type II or GDM, which may explain the slight variation in CHD incidence.²⁸

CONCLUSION

This study has shown that the frequency of congenital heart diseases in infants born to diabetic mothers with patent ductus arteriosus is the most common defect. So, we recommend that public awareness programs be arranged to educate the public about early screening and management of diabetes in pregnancy and proper antenatal checkups to prevent these defects.

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