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Evaluation of pre natal cardiac dysfunctions using echocardiography in pregnant females suffering from gestational diabetes mellitus in Kashmir division

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Abstract

Background: The pregestational diabetes prevalence is 2.2% with an overall prevalence of gestational diabetes mellitus of about 16.2% which can be contributed to the sedentary and dormant lifestyle of preganant females and change in their food habits. This gestational diabetes has increased the chances of fetal cardiac abnormality born to such mothers. Fetal Echocardiography can help to determine various treatment options available before and after delivery. It can also help to decide whether to continue with pregnancy or terminate it or to go for intrauterine interventions.

Objective: The main objective of the study was to evaluate the association of gestational diabetes with different fetal echocardiographic parameters.

Methods: The observational study was carried out in the Department of Radio-diagnosis and Imaging, GMC Srinagar of Kashmir in collaboration with Gynecology and Obstetrics department of LD hospital, after ethical clearance from institutional ethics committee from Dec 2020 to Dec 2022. 94 pregnant patients with pre and gestational diabetes mellitus were included in the study after taking the consent from the patients. Fetal echocardiography was mainly done at a mean gestational age of 25±3weeks depending upon the time of diagnosis of gestational diabetes and for pre-diabetic women. Statistical analysis was done using the MedCalc version 20.

Results: Among 94 patients, 23(24.46%) patients were diagnosed with cardiac dysfunction. Among 23 patients, 7 suffered from Structural heart diseases like 3 with ventricular septal defects, 2 with coarctation of aorta, 1 with Transposition of great arteries and 1 patient with hypoplastic left heart and 16 with cardiomyopathy.

Conclusions: There was an increased chance of fetal cardiac malformation in gestational diabetic women's. And, if they were diagnosed prenatally, clinical outcomes for both mother and fetus could have been better.

Keywords: Diabetes Mellitus, Echocardiography, Gestational Diabetes

Introduction

Gestational diabetes has a prevalence of about 16.2% and is reported as one of the common conditions nowadays. The common reason for the predisposition can be sedentary lifestyle of pregnant females and change in their food habits. The incidence of congenital malformation is five times more among newborns of females with gestational diabetes than that of the normal population.[1–3] Cardiac malformation is one of the most common types of malformation which occurs in 8.5% of the cases.[3–5] Common malformations seen in fetuses are VSD, the transformation of great arteries and vessels, aortic stenosis, pulmonary atresia, dextrocardia and conotruncal defects.[6–8]

Despite good glycemic control, hyperinsulinism and fetal hyperglycemia can cause hypertrophic cardiomyopathy which is the most common congenital abnormality of heart in the infants of diabetic mothers and is found in 30% of the cases, sometimes leading to sudden intrauterine fetal death.[9]

The objective of the study was to find out the prevalence of abnormal fetal echocardiography in gestational diabetic pregnant women's in Kashmir division done at Department of Radio-diagnosis and Imaging, GMC Srinagar of Kashmir referred by Gynecology and Obstetrics department of LD hospital.

Materials and Method

This observational study was conducted over a period of 2 years (Dec 2020 to Dec 2022) in the Postgraduate Department of Radiodiagnosis and Imaging, Government Medical Collage Srinagar. The pregnant women's who were diagnosed with gestational diabetes or who had pre-existing diabetes were referred from Department of Gynecology and Obstetrics of LD hospital to Department of Radio-diagnosis and Imaging, GMC Srinagar of Kashmir for fetal echocardiography were included in the study. Detail clinical history was taken and patients with heart disease, family history of congenital heart disease, hypertensive disorder, history of exposure to cardiac teratogens, Polyhydroamnion and multiple gestations were excluded from the study.

Fetal echocardiography was mainly done at a mean gestational age of 25±3weeks depending upon the time of diagnosis of gestational diabetes and for pre-diabetic women. Fetal echocardiography was performed by a radiologist with the assistance from a cardiologist by using Siemen ACCUSION 52000 Echocardiography Machine. Echo modalities were used to evaluate fetal heart through a transabdominal approach by two-dimensional echo (2-D echo), motion-mode echo (M-mode Echo), Doppler echo (continuous wave-Cw Doppler, pulsed wave Doppler), colour flow mapping. Standard transverse, four chamber, five chamber, three vessel view, arch and outflow and inflow track views.

Statistics

Continuous variables were summarized as mean and standard deviation. The proportion of fetuses with congenital heart diseases were reported in percentage. Categorical variables were summarized as percentages. Data was finally analysed using MedCalc version 20.

Results:

Among 94 patients, age of the patients include in the study was 27.8±5.32(Mean±SD) years as shown in **Table 1** and **Fig 1**. Multigravida females 60(63.8%) out of 94 were mostly diagnosed with gestational diabetes **Table 2** and **Fig 2**. Females with gestational age of 21.6±3.42 (Mean±SD) weeks were mostly diagnosed with gestational diabetes **Table 3** and **Fig 3**. Among 94 patients, 76 patients were on Insulin, 8 on Metformin and 10 on both Insulin and Metformin as depicted in **Table 4** and **Fig 4.** It was also concluded that out of 94 patients, 23(24.46%) patients were diagnosed with cardiac

dysfunction. Among 23 patients, 7 suffered from Structural heart diseases as shown in **Table 5** and **Fig 5** like 3 with ventricular septal defects **(Image I)**, 2 with coarctation of aorta **(Image II)**, 1 with Transposition of great arteries and 1 patient with hypoplastic left heart **(Image III)** and 16 with cardiomyopathy **(Image IV)** as shown in **Table 6** and **Fig 6**.

Table 1: Age distribution of study patients		
Age (Years)	Number	Percentage
20-25 Yrs	23	24.5
25-30 Yrs	42	44.7
30-35 Yrs	29	30.9
Total	94	100
Mean±SD (Range)=27.8±5.32 (20-34 Years)		

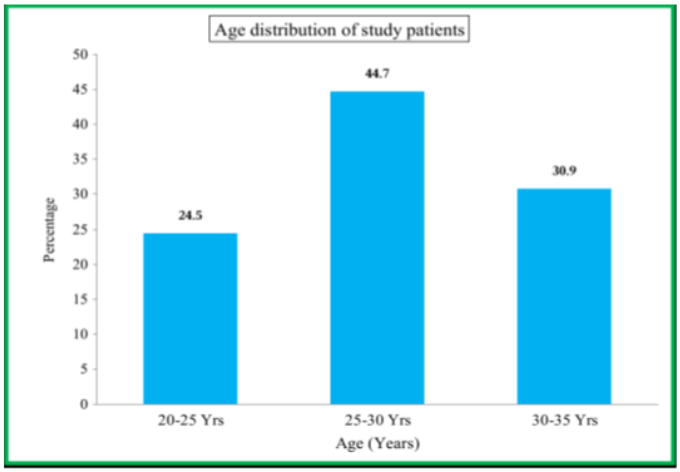


Table 2: Showing parity of study patients		
Parity	Number	Percentage
Primi Gravida	34	36.2
Multi Gravida	60	63.8
Total	94	100

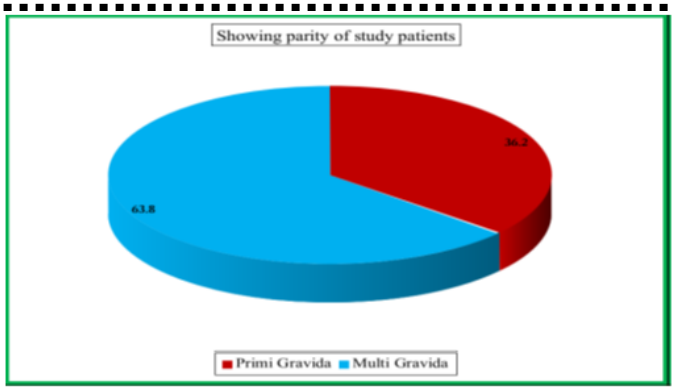


Table 3: Gestational age of study patients		
Gestational age (Weeks)	Number	Percentage
22-26 Weeks	45	47.9
26-30 Weeks	34	36.2
30-34 Weeks	15	16.0
Total	94	100
Mean±SD (Range)=21.6±3.42 (22-32 Weeks)		

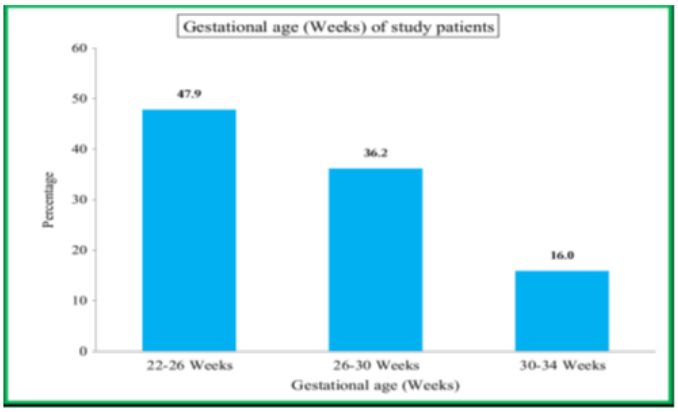
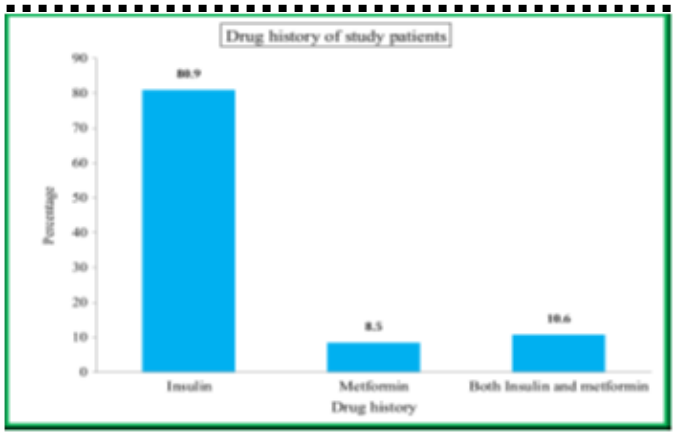


Table 4: Drug history of study patients		
Drug history	Number	Percentage
Insulin	76	80.9
Metformin	8	8.5
Both Insulin and metformin	10	10.6
Total	94	100



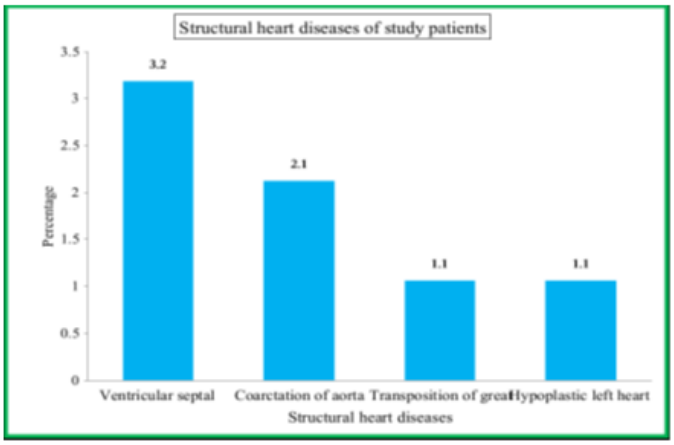


Table 5: Incidence of hypertrophic cardiomyopathy among study patients		
Hypertrophic Cardiomyopathy	Number	%
Present	16	17
Absent	78	83
Total	94	100

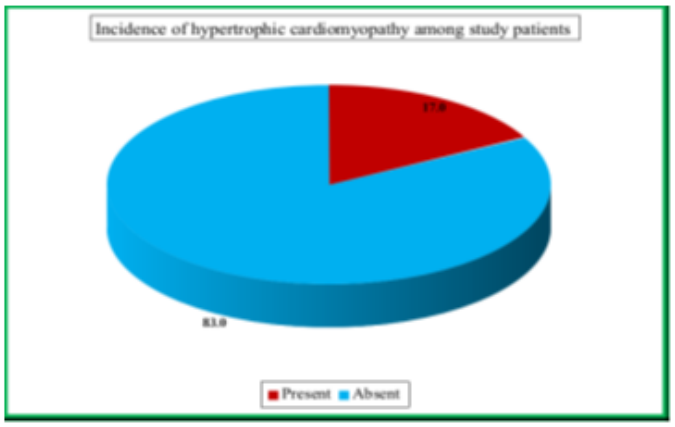


Table 6: Structural heart diseases of study patients		
Structural heart diseases	Number	%
Ventricular septal defect	3	3.2
Coarctation of aorta	2	2.1
Transposition of great arteries	1	1.1
Hypoplastic left heart syndrome	1	1.1
Total	7	7.4

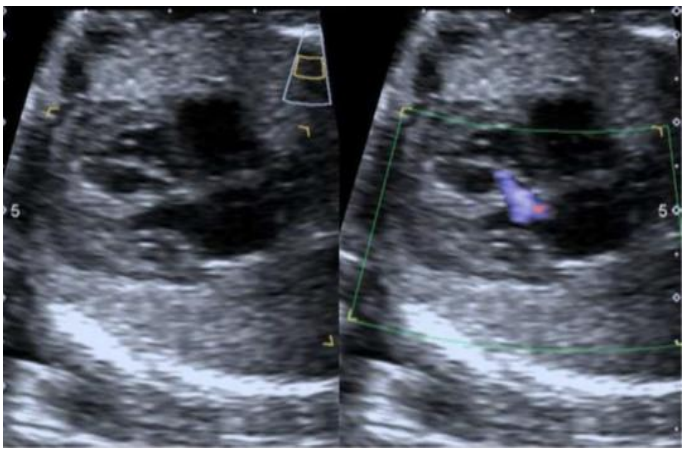


Image 1: Axial four chamber view in a fetus with small muscular ventricular septal defect

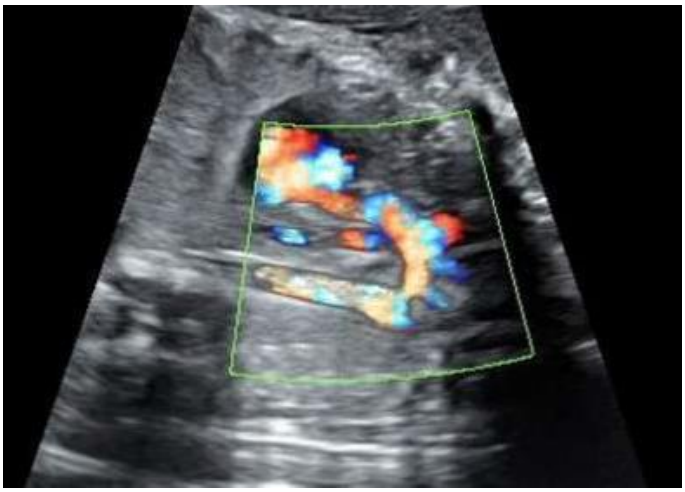


Image 2: Narrowing of aortic isthmus (Coarctation)

Image 3: 4 chamber view of the heart with narrow left ventricle and large right ventricle

Image 4: Axial 4 chamber view in a fetus of diabetic mother showing increased septal wall thickness (HOCM)

Discussion

According to the International Diabetes Federation in 2017, 16.2% of live births had some form of hyperglycemia in pregnancy and an estimated 85.1% were due to Gestational Diabetes Mellitus (GDM)[10]. This is very high prevalence. The prevalence of GDM in India varies in different parts of the country, depending on the geographical locations and diagnostic methods used. The prevalence of gestational diabetes has been reported to range from 7.8% in Kashmir[11], 9.5% in Western India[12] and 18.9% in Chennai.[13] In more recent studies, using different criteria, prevalence rates as high as 35% from Punjab,[14] and 41% from Lucknow have been reported.[15] The geographical differences in prevalence have been attributed to differences in age and/or socioeconomic status of pregnant women in these regions. This GDM has predisposed the fetus of such mothers to Cardiac dysfunction during second and third trimester. Myocardial hypertrophy and myocardial dysfunction occur as a result of hyperglycemia causing alteration in myocardial contractile protein most commonly in second trimester[16]. The ventricular septum is preferentially affected, but both right and left ventricular free-walls may be involved predominately the left one. Fetal echocardiography has emerged as a new technique for prenatal diagnosis of congenital heart diseases that has made the intra-uterine treatment possible[16]. Myocardial performance index (MPI) is non-invasive and useful Doppler derived parameter to evaluate global myocardial function[17]. As for incidence of congenital defects of heart are concerned 16 patients out of 94 patients suffered from hypertrophic cardiomyopathy and 7 patients were having structural heart diseases with 3 fetuses having VSD, 2 fetuses with coarctation of aorta,1 patient has TGA,1 patient with hypoplastic left heart. Our study concluded that 7.7 % of total diabetic referrals had structural heart diseases and is supported by Avisa Tabib et al. Regarding the frequency of structural heart diseases we found Ventricular septal defect to be the commonest which is supported by Russel NE et al.[15,18]. Diabetes mellitus has also been recorded to be more prevalent among multiparous women than in primigravida in our study however no literature is available to support this statement.

Conclusion

Echocardiographic parameters of fetuses of diabetic women were significantly different from those of uncomplicated non-diabetic women even though diabetic status was well controlled. There was an increased chance of fetal cardiac malformation in gestational diabetic women's. And, if they were diagnosed prenatally, clinical outcomes for both mother and fetus could have been better.

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