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Editorial

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Multi-modality Echocardiography for Cardiac Assessment in Fetuses of Pregnant Women With Diabetes Mellitus

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▸ See the article "Fetal Interventricular Septum Volume Evaluated by Three-Dimensional Ultrasound Using Spatiotemporal Image Correlation and Virtual Organ Computer-Aided Analysis in Fetuses From Pre-Gestational Diabetes Mellitus Pregnant Women" in volume 30 on page 125.

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Conflict of Interest
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Diabetes mellitus (DM) in a pregnant woman influences maternal and fetal/neonatal outcomes, such as stillbirth, congenital anomalies, macrosomia, hypoglycemia, birth injuries, polycythemia, and hyperbilirubinemia.[1] In the cardiovascular system, fetuses from diabetic mothers are at risk of congenital heart disease and hypertrophic cardiomyopathy. Specifically, myocardial hypertrophy was observed in about 40% of fetuses from diabetic pregnant women, and the interventricular septum (IVS) was the most affected cardiac structure.[2] Hypertrophic cardiomyopathy is characterized by an increased ventricular wall thickness with decreased ventricular cavity size, an impairment of the diastolic ventricular function because of the decreased ventricular filling, and a potential reduction in ventricular systolic performance.[3] The typical echocardiographic findings are hyper-contractile and thickened myocardium, septal hypertrophy disproportionate to the ventricular free walls, small ventricular chambers, and an anterior systolic motion of the mitral valve (MV), leading to left ventricular outflow tract obstruction.[3]

Although this is a transient condition with a prevalence exceeding 30% at birth and usually resolves by one year of age,[4] the prenatal diagnosis of myocardial hypertrophy is essential because this condition may be related to unexpected respiratory distress after birth and cardiomegaly in newborns.[5] So, the fetus from DM mothers must be evaluated for ventricular function, volume, and wall thickness. Traditionally, linear measurement of the IVS is accomplished through the M-mode-enabled prenatal detection of myocardial hypertrophy,[6] and IVS thickness measurement at the midpoint between the apex and base in the four-chamber view was the gold standard method for myocardial hypertrophy.[7] In assessment of ventricular function, speckle tracking echocardiography has been a novel clinical tool for regional and global myocardial function analysis for the last decade.[8] There were several studies of TDI and two-dimensional (2D) speckle tracking in infants of DM mothers, which showed impaired global longitudinal strain, abnormal cardiac torsion, lower S' and E' velocities, and higher E/E' ratios at MV, IVS, and tricuspid valve.[9][10]

Recently, not only 2D imaging methods, but also 3D ultrasound has been widely used to measure LV volume and assess valvular function.[8] The 3D ultrasound appeared in the

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mid-1990s, and spatio-temporal image correlation (STIC) has been available since the early 2000s.[11)12)] The fetal heart function and ventricular mass also could be evaluated by 3D ultrasonography using STIC and virtual organ computer-aided analysis (VOCAL) method.[13)14)] These modalities are more accurate than 2D ultrasonography, which obtains a single plane measurement. First, STIC improves the visualization of the interatrial septum, IVS, atrioventricular valves, and ventricular papillary muscles.[12)] Second, 3D ultrasonography enables the measurement of the external surface of irregularly shaped objects,[11)] and STIC using dynamic analysis (Cineloop) allows the assessment of cardiac volume by adjusting to the fetal heart's complete cardiac cycle.[15)] Third, the VOCAL software enables calculation of the volume of a fetal structure by rotating it around an axis.[16)]

Several studies have reported the fetal myocardial volume and function measured by 3D ultrasonography with STIC and VOCAL methods in the fetus from DM mothers.[17)18)] Reference values for fetal myocardial volume and IVS volume using STIC and VOCAL by 3D/4D ultrasound were already presented and seemed to be reliable and concordant.[19)20)] Bravo-Valenzuela et al.[21)] reported significantly smaller fetal left atrial volume in fetuses from pregestational DM women than healthy mothers. Melo Júnior et al.[20)] reported no significant difference in mean fetal myocardial volume between normal pregnant women and those with pregestational diabetes, whereas Edward Bravo-Valenzuela et al.[22)] showed the significantly higher fetal IVS volumes by 3D ultrasound with STIC with VOCAL methods in pregestational DM mothers than healthy mothers.

In conclusion, the prenatal diagnosis of myocardial function and wall hypertrophy in the fetus of DM mother is important. Moreover, the multi-modality evaluation using STIC and VOCAL by 3D/4D ultrasound is helpful in demonstrating the fetal heart.

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