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Assessment of Ventricular Septal Defects by Live Three-dimensional Echocardiography

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Objective
This study aimed to investigate the usefulness and feasibility of real-time three-dimensional transthoracic echocardiography (RT3D-TTE) in assessing ventricular septal defects (VSD) and compare the findings with those obtained by two-dimensional echocardiography (2D-TTE).
Methods
37 patients (19 girls, 18 boys) aged 1 month-16.5 years (mean 3.27±3.87, median 1. 50 years) with VSD diagnosed by 2D-TTE were prospectively examined by RT3D-TTE. The morphology, shape, number, size (maximum area, long and short axis diameters at end-diastole) of the defect, its relation and distance to the tricuspid and aortic valves, presence and degree of aortic overriding were analyzed by RT3D-TTE displaying the VSD in facing views from the right ventricular aspect; the results were compared to 2D-TTE findings in all and intraoperative findings in 20 patients. Standard transthoracic windows were used for 3D image acquisition; off-line measurements were used for quantitative analysis. VSD was isolated in 22 patients, existed as a component of congenital heart disease in 18, associated defects were present in 12 patients.
Results
Optimal RT3D-TTE images were obtained in 36 of 37 patients. Mean time required for 3D data acquisition was 4.09±1.49 minutes, and for image processing 20.13±10.46 minutes, declining significantly with the learning curve (r:-0.7, p<0,001). The VSD was perimembranous in 20, perimembranous-outlet in 9, perimembranous-inlet in 5, muscular in 2 patients; the defect was single in all. There was complete agreement on defect morphology between 3D-TTE, 2D-TTE and intraoperative findings. Although mean end-diastolic VSD diameter measured by 3D-TTE from the right ventricular facing view was significantly larger than the corresponding 2D-TTE diameter (16.3±8.7 vs 9.9±4.35mm, p<0.05), there was a good correlation between them (r=0.79, p<0.001). 3D-TTE was superior to 2D-TTE in visualizing the shape of VSD, measuring tissue rims from the aortic and tricuspid valves, and in defects hidden by ventricular septal aneurysm or tricuspid septal leaflet which can be erased digitally to reveal the VSD underneath.
Conclusions
RT3D-TTE provides reliable qualitative and quantitative information regarding the morphology, shape, size, tissue rims of VSDs from unique facing views, and may serve as a feasible and valuable tool in the assessment of these defects prior to transcatheter or surgical closure.