

Use of Non-Invasive Phase Contrast Magnetic Resonance Imaging for Estimation of Atrial Septal Defect Size and Morphology: A Comparison with Transesophageal Echo

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Abstract

Background: Transesophageal echocardiography (TEE) is a trusted method of sizing atrial septal defect (ASD) prior to percutaneous closure but is invasive, uncomfortable, and may carry a small risk of morbidity and mortality. Magnetic resonance imaging (MRI) may be useful non-invasive alternative in such patients who refuse or are unable to tolerate TEE and may provide additional information on the shape of the ASD.

Purpose: To validate the accuracy of ASD sizing by MRI compared with TEE.

Method: Twelve patients (mean age 30 years; range 11–60 years) scheduled for ASD closure underwent TEE, cine balanced fast field echo MRI (bFFE-MRI) in four-chamber and sagittal views and phase-contrast MRI (PC-MRI) with reconstruction using the two orthogonal planes of T2-weighted images as planning. The average of the three longest measurements for all imaging modalities was calculated for each patient.

Results: Mean maximum ASD length on TEE was 18.8 ± 4.6 mm, mean length by bFFE-MRI was 20.0 ± 5.0 mm, and mean length by PC-MRI was 18.3 ± 3.6 mm. The TEE measurement was significantly correlated with the bFFE-MRI and PC-MRI measurements (Pearson $r = 0.69$, $p = 0.02$ and $r = 0.59$, $p = 0.04$, respectively). The mean difference between TEE and bFFE-MRI measurements was -1.2 mm (95% CI: -3.7 , 1.3) and between TEE and PC-MRI was 0.5 mm (95% CI: -1.9 , 2.9). Bland–Altman analysis also determined general agreement between both MRI methods and TEE. The ASDs were egg-shaped in two cases, circular in 1 patient and oval in the remaining patients.

Conclusion: ASD sizing by MRI using bFFE and phase-contrast protocols correlated well with TEE estimations. PC-MRI provided additional information on ASD shapes and proximity to adjacent structures.

Keywords ASD - MRI - Phase - contrast imaging - TEE