MEASURING EFFECTIVE ORIFICE AREA IN PATIENTS AFTER AORTIC VALVE REPLACEMENT USING PHASE-CONTRAST CINE MAGNETIC RESONANCE IMAGING

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INTRODUCTION: Because mismatch of patients and prostheses increases postoperative mortality, it is a critical issue for patients undergoing aortic valve replacement (AVR). Mismatch can be determined by measuring the effective orifice area (EOA) of a prosthetic valve (1). Although EOA is usually measured by transthoracic ultrasonography, its accuracy remains unclear because the prosthetic valve and/or turbulent flow may produce artifacts, and results depend on the examiner's skill. We investigated the clinical feasibility of phase-contrast (PC) cine MR imaging for measuring EOA in patients after AVR, which we believe has not been reported, and compared our measurements to EOA reference values.

MATERIALS AND METHODS: For 11 asymptomatic patients (4 men, 7 women: mean age, 70.5±12.6 years) who underwent AVR and demonstrated no significant abnormality on transthoracic ultrasonography, we first performed segmented k-space, PC cine MR imaging at the level of the aortic annulus (AA) and left ventricular outlet tract (LVOT), then measured velocity-time integral (VTI) during the systolic cardiac phase at both the AA and LVOT levels and functional cross-sectional area (A) at the LVOT level. We finally calculated EOA (= A (LVOT)×VTI (LVOT) / VTI (AA)) using a continuity equation (2-3) and used linear-regression analysis and Bland-Altman plot to compare the EOA measurement and EOA reference value for the type and size of prosthesis being implanted.

RESULTS: Using PC cine MR imaging, we successfully obtained EOA measurement for all patients with little artifact from the prosthetic valve. The measurement and reference value correlated well (MR measurement = 1.16x – 0.04 cm^2: r = 0.70) (Fig. 1). All differences were within 0.2 cm^2 except two measurements (difference, 0.6 and 0.7 cm^2); the mean difference was 0.18 and the standard deviation (SD), 0.28 (Fig. 2).

CONCLUSION: PC cine MR imaging is clinically feasible for relatively easy and accurate EOA measurement in patients after AVR.

REFERENCES:

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Fig. 1

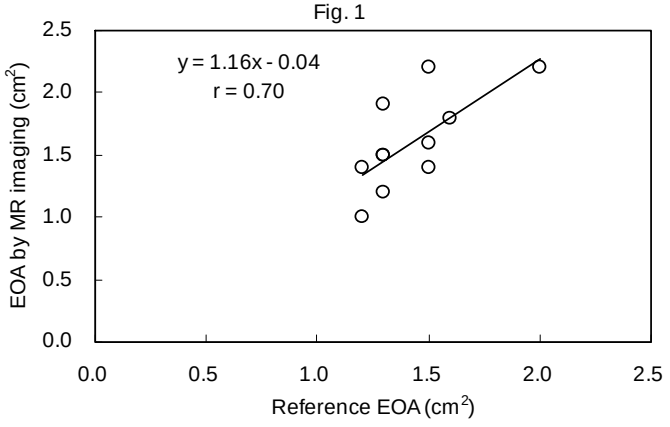

Fig. 2

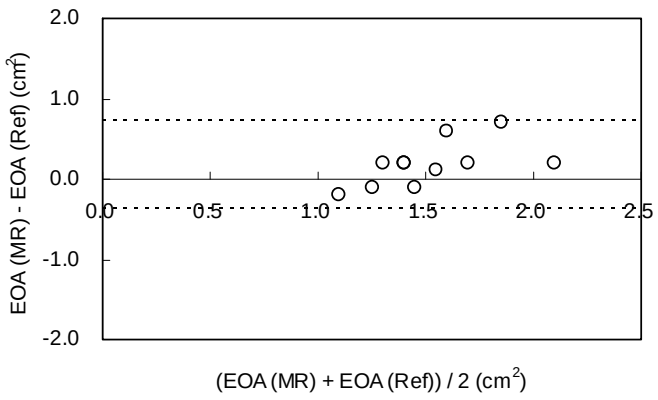

Figure: Linear regression analysis of the effective orifice area (EOA) reference value (x axis) and the EOA measurement by PC cine magnetic resonance (MR) imaging (y axis) (Fig. 1). The regression line, equation, and correlation coefficient are shown. Bland-Altman plot demonstrates that the MR measurement and reference value agree relatively well (Fig. 2). Dotted lines represent mean ± 2 standard deviation (SD).