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Meeting abstract

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1109 Quantification of the orifice area of bioprostheses in aortic position by cardiovascular magnetic resonance

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Introduction

Effective orifice area is a decisive parameter in patients' follow-up after aortic valve replacement (AVR) with bioprostheses and is usually calculated by continuity equation in transthoracic echocardiography (TTE). However, difficult sonic conditions after cardiac surgery in many patients obviate reliable quantification of the prosthetic orifice.

Purpose

This is the first series to test the feasibility of Cardiovascular Magnetic Resonance (CMR) as an alternative non-invasive method to quantify the orifice area of bioprostheses.

Methods

Patients were not eligible to enter the study if TTE conditions did not allow for reliable orifice calculation. Seventeen consecutive patients (mean age at CMR 72 ± 12 years, 13 males) after biological AVR (mean 3.4 ± 2.4 years ago; 15 stented and 2 stentless prostheses, labeled sizes 21–29, mean size 24.7 ± 2.5) were prospectively examined by TTE and CMR (1.5 T). Prosthetic orifice area was quantified by continuity equation (TTE) and by standardized planimetry by a blinded observer (CMR) using steady state free precession cine-acquisitions (slice-thickness 5 mm, TR 2.9 ms, TE 1.2 ms, FA 80°, matrix 256 × 146, field of view typically 340 mm, bandwidth 930 Hz/px). Slice positioning for planimetry was done stepwise using 2 orthogonal long and short axis cine-loops each sectioning through the prosthetic center. Cine-loops for planimetry were acquired as a stack of prosthesis-parallel slices (no interslice gap) starting immediately inferior of the prosthesis to correct for cardiac motion and allow for post-hoc determination of the optimally positioned slice. Planimetry was done by manually contouring the maximum orifice area (see figure 1) using the MASS-software (Version 6.2, Medis, Leiden, NL).

Results

CMR planimetry was feasible in 13 patients (76.5%) and not feasible in 4 (23.5%): Two patients with stented prosthesis had susceptibility artefacts due to the prosthetic alloy superposing the orifice area, in 2 patients turbulent transvalvular flow rendered image-quality non-diagnostic. Mean orifice area did not differ between TTE (1.78 ± 0.25 cm^2) and CMR (1.74 ± 0.26 cm^2; p = 0.42). Orifice areas by TTE and CMR correlated significantly (r = 0.75; p = 0.003). All 5 patients with patient-prosthesis mismatch in TTE, defined as an effective orifice area index ≤ 0.85 cm^2/m^2, also showed orifice areas ≤ 0.85 cm^2/m^2 in CMR planimetry.

Conclusion

CMR planimetry of the orifice area of bioprostheses in aortic position is feasible and shows a high degree of consistency towards standard calculation by continuity equation. This new approach might prove especially valuable in patients with poor acoustic windows.

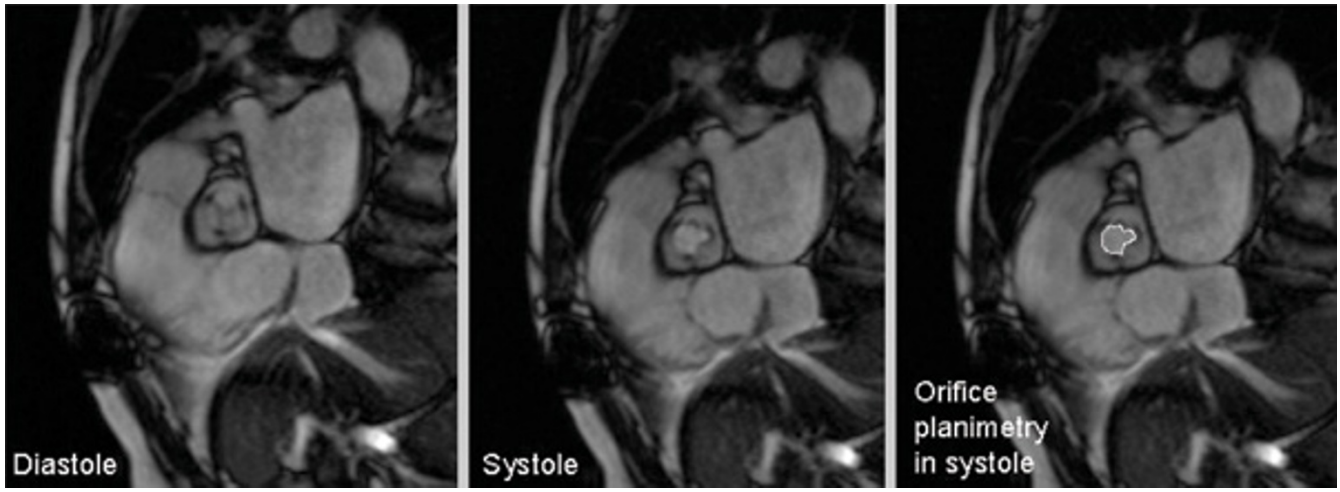

Figure 1
We compared magnetic resonance planimetry with echocardiographic continuity equation to assess the orifice area of aortic bioprostheses. Orifice areas correlated well between both methods. Thus, CMR planimetry may offer an alternative non-invasive method to quantify the orifice area of bioprostheses.