LOW IMPLANTATION DEPTH DURING TAVR INCREASES THE PRESSURE EXERTED ON THE ATRIOVENTRICULAR CONDUCTION SYSTEM: A BIOMEDICAL ANALYSIS

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1. INTRODUCTION

Low implantation depth has been associated with the occurrence of new conduction abnormalities after transcatheter aortic valve replacement (TAVR) [1]. However, the impact of implantation depth on the mechanical device-host interaction remains unclear [2].

We used patient-specific computer simulations to investigate the pressure that the frame exerts on the surrounding tissues in vicinity of the atrioventricular (AV) conduction system, at different implantation depths.

2. MATERIALS AND METHODS

Twenty patients who received an Evolut R (Medtronic, MN, USA) were included in this study. For each patient, a 3D aortic model was obtained from pre-operative CT images and a region of interest in vicinity of the AV conduction system was defined. Finite-element computer simulations were used to virtually implant the device at high, medium and low position. From each simulation the maximum contact pressure exerted by the frame on the region of interest and the relative area of contact were analyzed; differences were compared with the Friedman test.

3. RESULTS AND DISCUSSION

At high implantation depth (3.3±1.3 mm) maximum contact pressure and relative area of contact were 0.28 [0.06-0.38] MPa and 8 [2-13]% respectively, at medium implantation depth (7.2±1.3 mm) 0.48 [0.35-0.73] MPa and 29 [20-33]%, and at low implantation depth (10.9±1.3 mm) 0.62 [0.52-0.69] MPa and 50 [39-55]%.

Differences between the three different implantation depths were significant (p<0.001).

Figure 1. An example of high (a) and low (b) valve implantation in the same patient model and the obtained contact pressure (left). Region of interest in black.

Maximum pressure generated by the valve frame on the tissue in the vicinity of the AV conduction system and the relative area of contact increase with the depth of valve implantation.

References