A novel integrated surgical approach to chronic functional ischemic mitral regurgitation

Impact of adding papillary muscle relocation to down-sized mitral ring annuloplasty

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ABSTRACT

Functional ischemic mitral regurgitation (FIMR) is defined as mitral regurgitation secondary to myocardial infarction or coronary artery disease in patients with anatomically normal mitral valve leaflets and chordae. Chronic FIMR is observed in up to 10% of patients undergoing coronary artery bypass grafting and in up to 50% of patients after acute myocardial infarction. Chronic FIMR increases the risk of heart failure and long-term mortality up to four fold. Optimal surgical treatment for chronic FIMR is debated, but there is evidence that coronary artery bypass grafting alone is not sufficient. In this study we investigate the impact of adding papillary muscle relocation to down-sized ring annuloplasty in an animal experimental model. 3D cardiac MRI was applied to assess the mitral valve apparatus and the impact of the surgical procedures.

In substudy A, a porcine experimental model of chronic FIMR was developed using catheter based induction of postero-lateral myocardial infarction followed by right ventricular to promote left ventricular remodelling and dilatation.

In substudy B, 3D cardiac MRI was used to assess mitral valve geometry and papillary muscle position in chronic FIMR pigs and healthy controls. A good correlation was observed between our findings and previously published data from clinical studies on mitral valve apparatus geometry in chronic FIMR. Thus our porcine experimental model was considered clinically compatible.

In substudy C, two different surgical treatments for chronic FIMR were compared: 1) implantation of a down-sized annuloplasty ring in six chronic FIMR pigs (standard treatment), 2) five chronic FIMR animals received a down-sized ring annuloplasty and as adjunct procedure papillary muscle relocation towards the mitral valve. Cardiac 3D MRI revealed that adding papillary muscle relocation improved mitral leaflet geometry compared with ring annuloplasty alone. This difference was present after a short follow-up time of one week, but whether it persists and reduces the prevalence of recurrent FIMR in the long run remains to be adressed.