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STRUCTURAL

Persistence of Iatrogenic Atrial Septal Defect After Interventional Mitral Valve Repair With the MitraClip System

A Note of Caution

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ABSTRACT

OBJECTIVES The purpose of this study was to investigate the persistence rates of iatrogenic atrial septal defect (iASD) after interventional edge-to-edge repair with serial transesophageal echocardiography examinations and close clinical follow-up (FU).

BACKGROUND Transcatheter mitral valve repair (TMVR) with the MitraClip system (Abbott Vascular, Abbott Park, Illinois) is a therapeutic alternative to surgery in selected high-risk patients. Clip placement requires interatrial transseptal puncture and meticulous manipulation of the steerable sheath. The persistence of iASD after MitraClip procedures and its clinical relevance is unknown.

METHODS A total of 66 patients (76.7% male, mean age 77.1 ± 7.9 years) with symptomatic mitral regurgitation (MR) at prohibitive surgical risk (EuroSCORE II 10.1 ± 6.1%) underwent MitraClip procedures and completed 6 months of FU.

RESULTS Transesophageal echocardiography after FU showed persistent iASD in 50% of cases. Patients with iASD did not significantly differ from patients without ASD concerning baseline characteristics, New York Heart Association functional class, severity of MR, and acute procedural success rates ($p > 0.05$). When comparing procedural details and hemodynamic measures between groups, MitraClip procedures took longer in patients without iASD (82.4 ± 39.7 min vs. 68.9 ± 45.5 min; $p = 0.05$), and echocardiography after FU showed less decrease of systolic pulmonary artery pressures in the iASD group (−1.6 ± 14.1 mm Hg vs. 9.3 ± 17.4 mm Hg; $p = 0.02$). Clinically, patients with iASD presented more often with New York Heart Association functional classes >II after FU (57% vs. 30%; $p = 0.04$), showed higher levels of N-terminal pro-brain natriuretic peptide (6,667.3 ± 7,363.9 ng/dl vs. 4,835.9 ± 6,681.7 ng/dl; $p = 0.05$), and had less improvement in 6-min walking distances (20.8 ± 107.4 m vs. 114.6 ± 116.4 m; $p = 0.001$). Patients with iASD showed higher death rates during 6 months (16.6% vs. 3.3%; $p = 0.05$). Cox regression analysis found that only persistence of iASD ($p = 0.04$) was associated with 6-month survival.

CONCLUSIONS The persistence rate of 50% iASD after MitraClip procedures is considerably high. Persistent interatrial shunting was associated with worse clinical outcomes and increased mortality. Further studies are warranted to investigate if persistent interatrial shunting is the mediator or marker of advanced disease in these patients. (J Am Coll Cardiol Intv 2015;8:450–9) © 2015 by the American College of Cardiology Foundation.

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Transcatheter mitral valve repair (TMVR) has been developed as a therapeutic alternative to mitral valve (MV) surgery for symptomatic patients with relevant mitral regurgitation (MR) at prohibitive surgical risk. Interventional edge-to-edge repair with the MitraClip system (Abbott Vascular, Abbott Park, Illinois) has proven to be safe and effective for the reduction of MR in different patient cohorts with either functional mitral regurgitation (FMR) or degenerative mitral regurgitation (DMR) valve disease (1,2), and this technique has been widely adapted for clinical use, with more than 13,000 documented implants worldwide.

In clinical practice, TMVR with the MitraClip is mainly used to reduce FMR in end-stage heart failure patients with either dilated or ischemic cardiomyopathy (3–6). In this high-risk population, acute procedural success rates of up to 99% with significant MR reduction were reported (7), followed by symptomatic improvement in approximately 80% of cases.

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Nevertheless, TMVR with the MitraClip is still an evolving technique, and factors predicting clinical outcomes after technically-successful clip implantation are not well defined. Cardiologists are facing a complex procedure, and clip placement requires venous groin access, interatrial transseptal puncture, and advancement of a 21-F (7.2 mm) steerable sheath into the left atrium. Despite increasing knowledge on specific procedural characteristics and technical aspects of TMVR, the persistence rate of iatrogenic atrial septal defects (iASDs) after MitraClip procedures is unknown. Furthermore, the effect of iASD on clinical outcomes in patient cohorts with advanced stages of chronic heart failure has not been systematically investigated.

METHODS

In this prospective, single-center study, we included consecutive patients undergoing TMVR with the MitraClip system. All patients underwent close clinical follow-up (FU) and echocardiography after 6 months to determine functional results after TMVR and clinical outcomes.

PATIENTS. Symptomatic patients with relevant DMR grade 3 to 4+ were evaluated for TMVR or surgery. Patients with FMR and mitral regurgitation grade 2+ were considered for MR treatment when having an effective regurgitation orifice area of >20 mm^2, New York Heart Association (NYHA) functional class III to IV, concomitant atrial fibrillation, and/or elevated pulmonary pressure despite optimized medical and device therapy (8). TMVR was planned for patients if the heart team recommended against open-heart surgery.

The study was approved by local ethics committee and in concordance with the Declaration of Helsinki, and all patients had to provide written informed consent before study inclusion.

ECHOCARDIOGRAPHY AND FU ASSESSMENT. Echocardiographic assessment before and after TMVR was done following current recommendations and guidelines, including comprehensive transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) (9,10). Severity of MR was graded after determination of proximal isovelocity surface area, effective regurgitation orifice area, as well as vena contracta width and regurgitant volume (8,9). According to the EVEREST (Endovascular Valve Edge-to-Edge REpair Study) (7) and the recommendations of the European Society of Cardiology (9), we established an institutional standard categorizing the severity of MR following a scale ranging between 1 and 4+: grade 1 defines "mild," 2 refers to "moderate," 3 stands for "moderate to severe," and 4 stands for "severe" MR. TEE and TTE were performed with a commercially-available echocardiographic system (iE 33, Philips Medical Systems, Andover, Massachusetts) and echocardiography probes (X5-1, X7-2t) allowing acquisition of 2- and 3-dimensional datasets. For the determination of iASD during FU, the interatrial septum was visualized in multiple angulations with and without color Doppler to identify visible structural defect or atypical interatrial Doppler flow (**Figure 1**).

Different experienced echocardiographers obtained procedural (C.H., F.S.) and FU (R.S., C.Ö.) images. The echocardiographer who performed FU evaluation was blinded to procedural outcomes and the patients' characteristics. Trained study nurses carried out clinical FU evaluation, unattended by the interventionalists or procedural echocardiographer.

INTERVENTIONAL EDGE-TO-EDGE REPAIR OF MR. TMVR using the MitraClip system has been described in detail previously (7). During the MitraClip procedure, severity and acute changes of MR were assessed as supposed by Foster et al. (11) and Wunderlich and Siegel (12). We defined acute procedural success as a reduction of MR by at least 1 grade, with a residual MR <2+. The number of clips that were implanted to reach procedural success was left to the discretion of

ABBREVIATIONS AND ACRONYMS

DMR = degenerative mitral regurgitation

FMR = functional mitral regurgitation

FU = follow-up

iASD = iatrogenic atrial septal defect

MR = mitral regurgitation

NYHA = New York Heart Association

TEE = transesophageal echocardiography

TMVR = transcatheter mitral valve repair

TTE = transthoracic echocardiography