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Endocarditis after interventional repair of the mitral valve: Review of a dilemma☆,☆☆

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ABSTRACT

Background: The MitraClip procedure can be an alternative treatment option for patients with high surgical risk for whom surgical treatment is contraindicated. Patients with prosthetic material have an increased risk for infective endocarditis.
Hypothesis: Incidence, treatment and outcome of patients with endocarditis after interventional mitral valve repair are not known.
Methods: We searched for articles using PubMed using the terms "interventional mitral valve repair", "mitraclip" and "endocarditis". We have also searched for case reports in major congresses. Furthermore, we report two cases.
Results: Four cases of IE after MitraClip were found in addition to our cases. The leading cause is a bacterial infection, typically with staphylococcal bacteria. Approximately two thirds of these patients underwent surgery. Short-term outcome seems to be reasonable for these patients. During the early postoperative period and if *Staphylococcus aureus* can be cultivated mortality seems to be significantly elevated.
Conclusion: IE after MitraClip procedure is a dilemma. While surgical bail-out seems to be the favorable treatment option, patients were rejected conventional surgery in first place due to their high operative risk. Best treatment recommendation must be made on an individual basis. Predisposing factors should be conscientiously addressed prior to the procedure.

1. Introduction

Mitral valve regurgitation is the second most common heart valve disorder [18]. In general population, the prevalence is 1–2% but it is as high as 10% in patients older than 75 years [16]. Surgical mitral valve repair (SVR) is considered to be the standard treatment [24]. There are some patients with high surgical risk, however, for whom SVR is contraindicated. The interventional repair with the MitraClip system (Abbott Vascular, Santa Clara, CA, USA) can be an alternative treatment option. Both the EVEREST II trial and the ACCESS EU registry demonstrated the safety and efficacy of the device [11,12]. The most common complications are short-term periprocedural. Infective endocarditis (IE) after MitraClip procedure is rare but will increase with spread of procedure. We therefore aimed to review the literature for the incidence, treatment and outcome of IE after MitraClip procedure.

2. Methods

We searched for articles using PubMed database as well as bibliographical cross-references of all articles using the terms "interventional mitral valve repair", "mitraclip" and "endocarditis". Search results included six abstracts, however, only two of them actually discussed active endocarditis. Four of the articles had to be disregarded as they studied histopathological findings, e.g., in porcine model, or reviewed the procedure itself or its aftercare. We have also searched for these topics as case reports in major congresses. This included the congresses of the European Society of Cardiology and EuroPCR, the American College of Cardiology, Trans-Catheter Cardiovascular Therapeutics, and the American Heart Association. Furthermore, we report two cases of our own clinic. The study was performed in accordance with the ethical standards laid down in the 1964 Declaration of Helsinki and its later amendments.

Abbreviations: BNP, brain natriuretic peptide; CRP, C-reactive protein; IE, infective endocarditis; MR, mitral regurgitation; PCT, procalcitonin; SVR, surgical mitral valve repair; TOE, transesophageal echocardiography.

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3. Results

To our knowledge, four cases of IE after interventional repair of mitral valve regurgitation have been published (Table 1). The “”**first patient** was successfully treated with three clips in 2011 [17]. He was admitted three years after the procedure due to fever. Blood cultures were positive for *S. epidermidis*. The patient underwent surgery for replacement of a prosthetic valve and explantation of an internal cardioverter defibrillator (ICD). He was alive on day 52 after surgery. The case report did not provide further information on the clinical course or antibiotic regimen. The **second case** was a patient who had ruptured chordae with adherent material on the clip and presented with fever 5 weeks after the interventional repair [13]. She underwent surgery and the 1-year follow-up was reported as being uneventful. The **third patient** underwent a MitraClip procedure due to a high surgical risk with a logistic EuroSCORE of 30.4% [6,13]. The patient was readmitted 30 days later with fever and dyspnea (NYHA III). Blood cultures were positive for *Staphylococcus aureus* and an echocardiogram demonstrated recurrence of severe MR. An antibiotic regimen consisting of vancomycin, gentamicin and rifampicin was initiated. After heart team consultation, surgery was performed despite the increased risk (logistic EuroSCORE 56.8%, EuroSCORE II 25.3%). The patient was discharged and prescribed antibiotics for six more weeks. No further follow-up data were reported. The **fourth patient** presented with dyspnea and a weak popliteal pulse 14 months after MitraClip implantation [25]. CT angiography confirmed a blocked A. poplitea sinistra. Echocardiography demonstrated a highly mobile mass attached to the mitral valve. Blood cultures were positive for alpha-hemolytic streptococcus and antibiotic therapy was initiated. The patient remains under observation with serial echocardiograms. No further follow-up data were reported.

3.1. Case 1

An 83-year-old female patient was referred to the cardiology ward by her general practitioner. Her medical history included a moderate combined aortic stenosis and regurgitation, recurrent strokes within the scope of a Factor V Leiden thrombophilia, and a chronic obstructive pulmonary disease (COPD). Upon admission she described progressively increasing dyspnea (NYHA IV, brain natriuretic peptide 859 pg/ml) even at rest. Clinical examination showed massive peripheral edema as well as the typical signs of an erysipelas located on her right calf. Initial inflammatory markers were not significantly elevated (leukocytes 7.4 G/l, CRP 2.24 mg/dl, PCT <0.05 μg/l); however, treatment with levofloxacin was initiated for five days in addition to an intensified diuretic therapy. After recompensation, echocardiography revealed a severe, functional regurgitation of the mitral valve. Left ventricular function (LVEF) was severely impaired (35%). Coronary angiography revealed no relevant stenosis. The patient's case was discussed by the heart team and an interventional repair was recommended (EuroScore II 18.47%). The procedure was performed successfully in April 2015. One clip was placed centrally in location of P2/A2. A significant reduction of the regurgitation was achieved (MR grade I). Ten days after the procedure, however, the patient developed fever and hypotension. Inflammatory markers were markedly elevated (CRP max 206 mg/l, PCT max 1.5 μg/l) and hemocultures were positive for *S. aureus*. A transesophageal echocardiogram (TOE) confirmed endocarditis. Therapy with vancomycin and gentamicin was initiated. The EuroSCORE II indicated an increased perioperative mortality with a score of 68.65% [15]. A SVR was not recommended by the heart team. The patient developed a multiple organ failure with an acute kidney failure during the further course due to progressive sepsis. The patient subsequently died 14 days after the initial interventional procedure.

3.2. Case 2

A 76-year-old female patient was admitted with dyspnea (NYHA IV) in February 2015. Her medical history included a permanent atrial fibrillation, peripheral artery disease (Fontaine IIA), stroke without residual effects 01/2008, dual-chamber pacemaker 02/2008, and coronary heart disease. Her echocardiogram confirmed normal LVEF but revealed a severe, functional MR. Coronary angiography showed no progression of coronary disease. The case was discussed by the heart team, and because of the high surgical risk an interventional repair was recommended (Table 2). Two clips were implanted. Unfortunately, no significant reduction of the regurgitation was achieved (Fig. 1, Moving Image 1). The patient developed fever on day 8 accompanied by a relevant rise in the inflammatory markers (leukocytes 9.7 G/l, CRP 180 mg/dl, PCT 5.6 μg/l). She showed clinical signs of a pneumonia (productive cough, increased respiration rate, chest pain, and fatigue) and local signs of a peripheral venous catheter infection. Antibiotic treatment with tazobactam was therefore initiated. Blood cultures showed tazobactam-sensitive *S. aureus* on day 9. The patient was discharged after 10 more days to start her rehabilitation. Two days later, however, she was readmitted due to fever up to 40 °C. Blood tests showed clear evidence of bacterial infection (leukocytes 27 G/l, CRP 90 mg/dl, PCT 40 μg/l) and blood cultures contained *S. aureus* again. TOE revealed a highly mobile mass attached to the ventricular pacemaker lead (~10 mm) and the mitral valve (4 × 8 mm) (Figs. 1 and 2, Moving Image 2). Antibiotic therapy with vancomycin, rifampicin, and gentamicin was initiated. She agreed to undergo surgery 14 days later with replacement of the valve and placing an epicardial pacemaker system. An emergency re-sternotomy was necessary due to pericardial tamponade. The antibiotic regimen was prescribed for the following 6 weeks. On the day of her hospital discharge, she became unconscious and resuscitation was initiated. TOE,

Table 1
Case reports of infective endocarditis after interventional repair of the mitral valve.

No.	Reference	Age	Sex	Major comorbidities	No. of clips	Time after clip	Predisposing factors	Pathogen	Treatment	Outcome
1	Saito et al. [17]	52	M	Chronic kidney disease Diabetes mellitus	3	3 years	Dialysis	St. epidermidis	Surgery	Alive after 52 days
2	Maznikoski et al. [13]	Unknown	F	Unknown	Unknown	5 weeks	Unknown	Unknown	Surgery	Alive after 1 year
3	Frerker et al. [6]	88	M	Chronic kidney disease stage III Pulmonary hypertension	2	30 days	Unknown	*S. aureus*	Surgery	Alive after 15 days
4	Vazir et al. [25]	67	M	Coronary heart disease	1	14 months	Aortic valve prothesis	Alpha-hemolytic streptococcus	Conservative	No follow up
5	Case 1	83	F	COPD Stroke	1	14 days	History of erysipelas	*S. aureus*	Conservative	Death after 2 weeks
6	Case 2	76	F	Stroke	2	22 days	Peripheral venous catheter	*S. aureus*	Surgery	Death after 31 days

F = female, M = male.

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