Case Report

Early Implantation of Cardiac Resynchronisation Defibrillator (Crt-D) in a Patient with Percutaneous Mitral Annuloplasty: Feasibility and Synergic Effect, A Case Report

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ABSTRACT

Functional mitral regurgitation (MR) is a common problem in patients with chronic heart failure (HF) due to dilated cardiomyopathy, regardless of a etiology and is associated with increased morbidity and mortality in heart failure patients. MR presents a complex and multifactorial pathophysiology and despite many studies in the literature, there is not a clear validated strategy for the management of symptomatic patients with severe left ventricle (LV) dysfunction and concomitant severe MR.

We present a case of a 65-year-old man with symptomatic HF and severe ischaemic MR, who underwent a successful percutaneous trans-coronary venous mitral annuloplasty with the Carillon system. The procedure resulted in clinical improvement as well as in a decrease of MR at follow-up visit assessed by echocardiography. Only one-week later Carillon implant, the patient experienced a syncope caused by sinus node dysfunction and episodes of paroxysmal A-V block. Due to his arrhythmic risk and need of pacing, he underwent cardiac resynchronisation defibrillator (CRT-D) device implantation, resulting in a further improvement in echocardiographic measures of MR and his functional status.

This case shows the feasibility of early implantation of CRT-D after percutaneous mitral annuloplasty and suggests a possible synergistic effect of both therapies, even if future clinical trials are needed to confirm such observation.

Keywords: Functional mitral regurgitation, Heart failure, Percutaneous annuloplasty, Cardiac resynchronisation defibrillator

Introduction

Functional mitral regurgitation (MR) is a common finding in systolic heart failure (HF) patients due to dilated cardiomyopathy, related to increase of morbidity and mortality, conditioning the prognosis of the disease [1].

The association between severe left ventricle (LV) systolic dysfunction and MR is typically due to dilatation of mitral annulus in the absence of structural mitral valve abnormalities which contributes to progressive adverse remodelling and worsening of symptoms [1-3].
In patients with left bundle branch block (LBBB) with “wide” QRS complex several randomized trials showed that cardiac resynchronization therapy (CRT) reduce symptoms, reduce LV end-systolic volume (LVESV), cause reverse remodelling, improve LV function and reduce MR [3-9].

In patients with no indication to CRT surgical annuloplasty has been shown to reduce New York Heart Association (NYHA) class and LV dimensions, but commonly is indicated in the context of surgical revascularization [10]. In patients deemed at risk for surgical intervention, application of percutaneous approaches including Mitraclip [11] and application of direct or indirect mitral annuloplasty have shown promising results. The clinical effects of combined percutaneous mitral annuloplasty and cardiac resynchronization therapy in MR patients with heart failure remain unknown. We report a case of a patient implanted successfully with CRT-D only one week after percutaneous mitral annuloplasty with the Carillon system.

Case Presentation

A 65-year-old male was referred to our centre because of frequent episodes of congestive heart failure. His medical history was characterized by ischaemic cardiomyopathy (in March 2017 he suffered of acute coronary syndrome and the coronary angiography presented severe foci stenosis on the right coronary artery treated with PTCA and a drug eluting stent), chronic obstructive pulmonary disease, chronic kidney disease. At admission he assumed Ramipril 5mg/die, Bisoprolol 2.5mg/die, Furosemide 50mg/die, Spironolactone 25mg/die, Acetylsalicylic 100mg/die, Ticagrelor 90 mg twice daily; Atorvastatin 40mg/die. The ECG was consistent with sinus rhythm at HR of 75 bpm, QRS duration was 120 msec. The echocardiogram showed LV dilatation (LVESV: 125ml), systolic dysfunction (LV ejection fraction of 25%), severe MR with no structural changes within the mitral apparatus, severe tricuspid regurgitation and severe pulmonary hypertension. Blood pressure was 103/78 mmHg, pulse 75/min. His functional status was NYHA class II-III.

On the 9th of May 2017 at our centre, the patient underwent percutaneous mitral annuloplasty with the Carillon system (Cardiac Dimensions Inc, Kirkland, WA, USA) under fluoroscopic guidance in order to reduce mitral regurgitation. Coronary sinus (CS) was cannulated from the right internal jugular vein with a 9 French delivery catheter. To provide stable anchoring, a distal anchor; oversized relative to the venous dimension was deployed deep in the CS. Traction was then placed on the delivery system to plicate the periannular tissue. The degree of traction was guided by both fluoroscopic and echocardiographic assessments. Once tissue plication was optimized, the proximal anchor was deployed near the CS ostium. The Carillon device size used during the procedure was 11x18x60 mm.

Unfortunately, few days later, the patient experienced a syncope without prodromes in our department. The Holter monitoring recorded episodes of paroxysmal A-V block with significant asystole (4.5 sec.).

Because of the arrhythmic risk and the need of pacing, we decide to implant a transvenous ICD. The QRS was only tiny prolonged (120msec) but we implant also a LV lead in order to have another chance to reduce MR and to not re-operate the patient in case of further QRS widening.

On the 16th of the same month, the patient underwent a CRT-D implantation (Abbott, Quadra Assura MP device). During implantation after mitral annuloplasty with the Carillon™ device. (Figure 1).

Before positioning of the left ventricular lead patients underwent control coronary angiography and intravascular ultrasound of the coronary sinous to exclude any compression of the circumflex coronary artery and to evaluate the CS lumen and endothelialization of the mitral valve annuloplasty device, respectively. The implantation of CRT lead into the coronary sinus was simplified by the visibility of Carillon™ device during fluoroscopy as well as wide opening of the coronary sinus ostium by the proximal anchor of the device. After the coronary sinus angiography, postero-lateral branch was detected and left ventricular lead successful implanted in this branch. We decided to turn-off the CRT function according to current ESC Guidelines.

At patient discharge, according to optimal medical therapy, we prescribed also Ivabradine 5mg twice daily.

The patient was evaluated at baseline and at 1-6-12-18 months after Carillon and CRT implant. After one month, the MR was unchanged. After six months the MR improved from severe to moderate as a result of Carillon system, but there were not improvements of LV systolic function and geometry and without change of his functional status. The percentage of ventricular pacing detected by the device was over the 40% due to paroxysmal A-V block, so at 6 months we turned on CRT function with multi point pacing without drug therapy modification. At 12 months, there was a significant improvement in functional class (NYHA I-II) and also echo parameters enhanced as a result of both CRT and Carillon device. The EF was 30% and LVESV was 107 ml; there were not physical signs of congestion, so we reduced Furosemide’s dosage to 25mg/die. Even at 18 months the patient showed further improvement in symptoms and enhanced LV geometry (EF 35%; LVESV 97ml) without therapy modifications.

Discussion

Functional mitral regurgitation is a common complication of LV dysfunction both in ischaemic and non-ischaemic cardiomyopathy. After myocardial infarction, the prevalence of MR varies from 20 to 50%. The presence of moderate or severe MR is associated with a 3-fold increased risk of heart failure and a 1.6-fold increased risk of death at 5-year follow-up. A linear correlation is found between degree of FMR and mortality and morbidity [8].

![Figure 1: Fluoroscopy of cardiac resynchronisation therapy (CRT) implantation after mitral annuloplasty with the Carillon™ device.](image-url)
The MR could be managed by both cardiac resynchronization therapy and mitral valve surgery. Clinical decision making regarding the appropriateness of mitral-valve surgery vs CRT is a challenging task.

Despite many different approaches and surgical options, the evidence suggests that there is no obvious superior technique for treating MR. Patients in functional Classes III and IV, despite optimal medical treatment reduced LV ejection fraction and QRS duration > 120 ms (according to current guidelines) are good candidates for cardiac resynchronization therapy that may reduce the degree of mitral regurgitation [9]. CRT Trials reported at least the MR grade before and after CRT implantation demonstrating a small but significant reduction in MR severity at 3–6 months [3,8].

On the other hand, if no improvement occurred, it is unlikely that a further improvement of MR and mitral valve (MV) surgery could be considered. New percutaneous procedures of MV repair are also an option for MR uncorrected by CRT [12] or in patients not eligible to CRT.

Auricchio et al. recently demonstrated that, in non-responders to CRT, MitraClip treatment is feasible and safe. Most of the patients (73%) had improved NYHA functional class already at discharge. The first significant improvement in both LV volume and EF was detected after 6 months with a further improvement at 12 months. Seifert et al. [8] confirmed the safety of MitraClip treatment in the context of both functional and degenerative MR.

The current standard of care for patients with structural severe MR is cardiac surgery. However, there is a large patient population suffering from MR that is currently not treated with heart surgery because of significant morbidity and mortality risks. In FMR annuloplasty is the mainstay treatment and is performed by prosthetic annuloplasty devices (MitraClip or Carillon system) and in suitable cases represents a good alternative in patients without indication to CRT [2,11,13].

The efficacy and safety of percutaneous mitral annuloplasty with the Carillon device for the treatment of MR in systolic HF patients have been evaluated in the AMADEUS [10,14] and TITAN [15,16] trials. TITAN trial confirmed considerable improvement of MR as assessed by both echocardiography and functional tests at 24 months of follow-up and it showed decrease in the LV diastolic volume as reverse remodelling after Carillon device implantation.

In our patient the Carillon device was implanted in the coronary sinus without any complication and at the first time, only one week later, the patient underwent a successful CRT device implantation [17–21].

Although the QRS was only 120 ms we decided to implant a LV lead in order to have another option to reduce FMR and to avoid the risk related to upgrading procedure in a short time [22–25]. At six months we decided to turn on the CRT because the high percentage of RV pacing [23,26]. In this case, the preventive implantation of a biventricular ICD was the best choice.

Whether CRT may exert an additional beneficial effect in patients undergoing percutaneous mitral annuloplasty remains to be established. To the best of our knowledge, this is the first demonstration of simultaneous implantable of CRT and percutaneous trans-coronary-venous mitral annuloplasty that shows not only its feasibility but also a possible synergistic effect of both therapies in selected patients.

**Conclusion**

In our patient the implantation of mitral annular remodeling device and CRT-D was feasible, safe, effective and it could have potential synergistic effect in FMR reduction.

The verification of the clinical effects of combined Carillon implantation and CRT requires future clinical studies.

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**Conflicts of Interest**

Sara Innocenti is an Engineer employee in HT MED.

**Ethics approval and consent to participate**

The patient provided informed consent.

**Consent for Publication**

Informed consent was obtained from the patient for publication of this case report and any accompanying images. A copy of consent is available for review by the Editor-in-Chief of this journal.

**Authors’ Contributions**

RC prepared the main manuscript and abstract with assistance from MA and SI. All authors read and approved the final manuscript.

**References**


