ESC European Society of Cardiology

European Heart Journal - Case Reports (2020) **4**, 1–5
doi:10.1093/ehjcr/ytz238

CASE REPORT
Heart failure

MitraClip® as bridging strategy for heart transplantation in Chagas cardiomyopathy: a case report

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Received 24 July 2019; first decision 28 August 2019; accepted 13 December 2019; online publish-ahead-of-print 18 January 2020

Background Patients with end-stage heart failure, suffering from severe pulmonary hypertension (PH) and elevated pulmonary vascular resistance, are not eligible for heart transplant due to high mortality risk and primary graft dysfunction. Severe PH may be favoured by functional severe mitral regurgitation, which is present in many cardiopathies like end-stage Chagasic cardiomyopathy.

Case summary We present a case of a young man with end-stage heart failure secondary to Chagas cardiomyopathy with severe functional mitral regurgitation (FMR) and severe PH. The patient received percutaneous correction with MitraClip® system reducing PH and making him a suitable candidate for heart transplant.

Discussion In patients with advanced heart failure, FMR, and severe PH, optimal treatment according to current guide lines is recommended. MitraClip® therapy appears to be safe and effective for control of severe PH as a bridge measure for cardiac transplantation.

Keywords Case report • Heart failure • Chagasic cardiomyopathy MitraClip® • Pulmonary hypertension • Heart transplant

Learning points

- Chagas cardiomyopathy is a common condition in Latin America. Due to globalization and migration more cases have been noticed in Europe and the USA
- In patients with advanced heart failure, functional mitral regurgitation, and severe pulmonary hypertension (PH), MitraClip® therapy appears to be safe and effective for control of severe PH
- Mitraclip® can be a reasonable therapy in these patients and serve as a bridge prior to cardiac transplant.

Introduction

In Latin America, Chagas cardiomyopathy (Ch-CMP) is a public health problem that affects 5 700 000 people.[1] Arrhythmias and heart failure (HF) are the leading causes of death in this group of patients, being present in up to 43%[2] of affected individuals. Functional mitral regurgitation (FMR) and severe pulmonary hypertension (PH) are often described in patients with dilated Ch-CMP and can be potentially fatal in a population with low heart transplant (HT) and left ventricular assistance device rates due to low organ donation or poor access to advanced therapies.

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Handling Editor: Nikos Papageorgiou

Peer-reviewers: Subhi Akleh, Debabrata Bera, and Constantinos Bakogiannis

Compliance Editor: Amir Aziz

Supplementary Material Editor: Peregrine Green

There is data that suggests safety, viability, and benefits of MitraClip® system (Abbott Vascular) for patients with FMR even in advanced stages of the disease and as prevention of PH progression.[3] This is the first case described of Ch-CMP with severe PH and FMR, in which MitraClip® was used as a bridge to improve PH secondary to left heart disease (PH-LHD) by preventing its passive and reactive components that eventually lead to heart transplant.

Timeline

Date	Events
June 2015	Male patient with past personal history of Chagas cardiomyopathy (Ch-CMP) and permanent non-valvular atrial fibrillation presented signs and symptoms of decompensated heart failure with severe systolic dysfunction
July 2015	Stage D, Chagas cardiomyopathy was diagnosed without optimal respond to medical therapy
May 2016	Functional severe mitral regurgitation was evidenced
June 2016	Severe pulmonary hypertension was noticed in right heart catheterization (RHC)
26 October 2016	Mitral clip was implanted
April 2017	Control RHC showed improvement in pulmonary pressures with concomitant improvement in cardiac output and left ventricular filling pressures
6 October 2017	Heart transplant was made
October 2018	In ambulatory follow-up no heart failure symptoms or rejection events were presented. Clinical evolution was satisfactory

Case presentation

A 38-year-old man arrived to Heart Failure Department with 2 months of dyspnoea, limbs oedema, orthopnoea, palpitations, and chest discomfort. He had history of Ch-CMP and permanent non-valvular atrial fibrillation; coronary artery disease had previously been excluded by coronary arteriography. He was on optimal medical therapy according to current heart failure guidelines and also receiving anticoagulation with Apixaban. He underwent implantable cardioverter-defibrillator implantation as primary prevention of sudden cardiac death.

Upon physical examination he appeared to be congestive, tachypnoeic, and with raised jugular venous pressure at 45°. Heart sounds were irregular with pansystolic murmur at the apex irradiated to the axilla; pulmonary auscultation revealed reduced breath sounds bibasally. He had ascites and Grade III oedema in lower extremities.

Initial troponin I was positive without change in subsequent measurements, interpreted as chronic injury associated with heart failure. Electrolyte levels were normal and renal function was preserved (*Table 1*).

Table 1 Initial blood test

	Results	Reference values
Troponin I		
First value (pg/mL)	40	0–34
Second value[a] (pg/mL)	40	0–34
Creatinine (mg/dL)	0.8	0.5–1.0
Blood urea nitrogen (mg/dL)	30	7–20
Sodium (mEq/L)	140	135–145
Potassium (mEq/L)	4.2	3.5–5.5
WBC count (cells/μL)	7500	4000–1100
Haematocrit (%)	38	37–45
Haemoglobin (g/dL)	13	12–15
Platelets (cells/μL)	256 000	150 000–450 000

WBC, white blood cells.
[a]0/1 h high-sensitivity cardiac troponin T protocol.

Transoesophageal echocardiography showed a dilated mitral ring (47 mm), lack of leaflet coaptation resulting in FMR (effective regurgitant orifice area: 0.4 cm^2, regurgitation volume: 42 mL), severely dilated left ventricle (index volume: 131 mL/m^2, reference: 35–75 mL/m^2), severe systolic dysfunction [left ventricle ejection fraction (LVEF): 20%, reference: 52–72%], moderately dilated right ventricle, and severe PH [pulmonary systolic artery pressure (PsAP) 67 mmHg] (*Figure 1*). Mitral regurgitation was classified as severe in accordance with established reference value for FMR in the European guideline for valvular disease.

Despite optimal medical treatment, he presented worsening of symptoms and recurrence of hospitalizations. Stage D Ch-CMP was diagnosed, and heart transplant was considered.

Right heart catheterization (RHC) for pre-transplant study was performed. *Table 2* showed high mean pulmonary artery pressure (mPAP 57 mmHg) and persistent elevated mPAP after vasodilator administration (nitroprusside 3 μg/kg/min and prostaglandin 0.02 μg/kg/min), consistent with severe fixed post-capillary PH (*Table 2*).

During the follow-up, the patient presented clinical deterioration and further increase of PH making him ineligible for heart transplant. Our heart team considered MitraClip® implant in order to decrease FMR severity, improve haemodynamic variables, and reduce pulmonary pressure that would allow considering HT candidate.

The procedure was performed 3 months after initial referral, and the clip was successfully implanted, resulting in a reduction of FMR from severe to moderate without any complications (*Figure 2*). Six months after cautious treatment with MitraClip®, pulmonary pressures and cardiac output improved (*Table 1*) with stable moderate FMR on transthoracic echocardiogram.

The patient remained clinically stable in the following months and underwent to a successful heart transplant 1 year after MitraClip® implantation.

Currently, the patient has no heart failure symptoms, ventricular function is preserved without rejection signs and no reactivation of Chagasic disease has been observed.

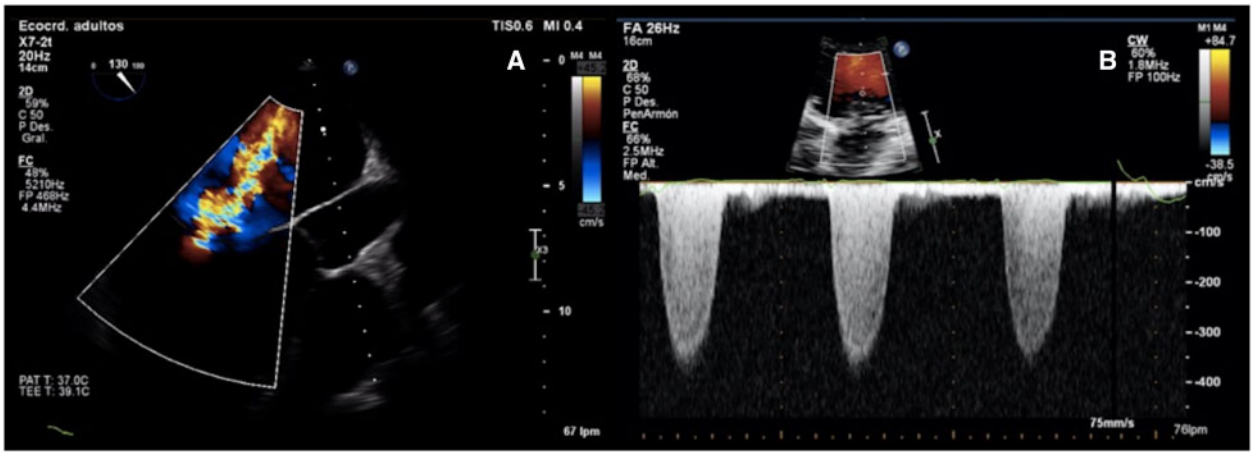

Figure 1 Transoesophageal projection at 130 degrees show mitral regurgitation jet (*A*); its evaluation with continuous Doppler reveals dense and triangular jet of low velocity due to ventricular dysfunction and atrial enlargement (*B*). Quantitative evaluation evidenced effective regurgitant orifice area of 0.42 cm^2, regurgitation volume of 42 mL, and end diastolic left ventricle volume of 131 mL/m^2; assessed together were consistent with severe mitral regurgitation.

Table 2 Right heart catheterization results prior to MitraClip®, through nitroprusside and prostaglandines and results 6 months post-intervention, improved after MitraClip® implantation

Haemodynamics	Basal	Nitroprusside progressive dose 3 µ/kg/min (pre-procedure on OMT)	IV prostaglandins 0.02 µ/kg/min (pre-procedure on OMT)	Six months post-MitraClip®
Systolic systemic pressure (mmHg)	106	90	99	90
Mean pulmonary pressure (mmHg)	52	37	48	29
CVP (mmHg)	14	6	12	15
PCWP (mmHg)	30	21	25	18
CO (L/min)	3	4.8	4.6	6
TPG (mmHg)	22	16	23	11
PVR (WU)	7.3	3.3	5	1.83

CO, cardiac output; CVP, central venous pressure; OMT, optimal medical treatment; PCWP, pulmonary capillary wedge pressure; PVR, pulmonary vascular resistance; TPG, transpulmonary gradient.

Discussion

Patients with end-stage HF are frequently affected by FMR (45–75%)[4] and its management remains extremely challenging.

In left-side heart failure, ventricular morphology is altered due to cavity enlargement and due to disarranged closure mechanism of mitral valve, left ventricular, and atrial pressure increases. With HF progression, irreversible changes in pulmonary vasculature occur causing severe PH.[5] Left-side heart failure is the main cause of PH being in 65–85% of the cases.[6]

In selected patients for heart transplant, pre-existence of severe PH [sPAP > 50 mmHg, transpulmonary gradient (TPG) > 15 mmHg, or pulmonary vascular resistance > 3 WU] is critical, favouring the development of right ventricular failure and causing 20% of deaths in early post-transplant period.[7,8]

Studies have shown several benefits on pulmonary pressure reduction after MR surgical repair (39% decrease in PsAP in 1 year) and with percutaneous repair (8% of decrease in PmAP).[9,10] The German Registry of Transcatheter Mitral Valve Interventions, which includes a high percentage of patients with FMR, displayed reductions in FMR severity. Along their analysis in PH groups, it demonstrates reductions between 4 and 10 mmHg in pulmonary systolic pressures, resulting in greater benefits for patients with pulmonary pressures before intervention of 40 mmHg or more. This data has limitations including being part of sub-registry analysis and the lack of invasive RHC correlation.[11]

Data about MitraClip® efficacy has been demonstrated both in retrospective and prospective studies; these trials illustrates MitraClip® utility in improving symptoms, functional class and and pulmonary pressures and even as a bridging strategy for heart

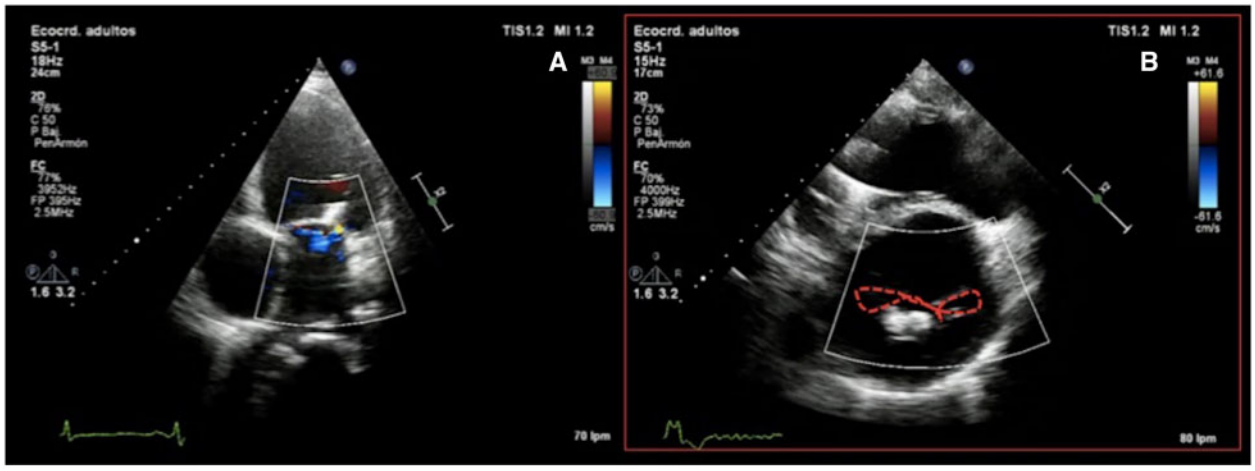

Figure 2 Apical four chamber view with Doppler colour showed mild mitral regurgitation jet (*A*). In sternal short axis of mitral valve, it is possible to appreciate a figure that resembles a bow tie with central clip (*B*).

transplantation in a patients with FMR and severe PH initially considered unsuitable for heart transplant. Regard this statement, we found five patients with dilated heart disease undergoing Mitraclip® implantation as a bridge for transplant therapy (three ischaemic, one valvular, and one idiopathic).[12–14] All of them with severe ventricular dysfunction (24% LVEF), severe ventricular dilation (index left ventricular end diastolic volume 129 mL/m^2), and severe PH (50 mmHG mPAP, TPG: 16 mmHg). After the procedure, parameters improved by about 40% and patients were successfully transplanted between 8 and 15 months post-implantation.[14] Echocardiographic and pulmonary pressure characteristics in our patient were very similar to those described, with the only difference in the aetiology, since in our case it is Ch-CMP, being in our knowledge the first reported case.

Despite mitral regurgitation and PH mechanism in Ch-CMP is similar to idiopathic, ischaemic, valvular, or dilated heart disease, it is necessary to describe the results in this type of disease since it is a frequent cause of heart failure in Latin America. The information provided about this pathology could be useful for medical groups that treat this kind of patients.

Conclusion

This is the first reported case of an end-stage Ch-CMP who underwent Mitraclip® bridge to HT. In fact, there are no specific recommendations regarding percutaneous repair for mitral valve as a bridge therapy for heart transplant in patients with FMR and PH-LHD.

In our case, a reduction in FMR severity was noticed, as well as a major improvement in haemodynamic measurements in right and left heart catheterization 6 months after the procedure, which allowed us to keep him on the waiting list and finally proceed with HT. With increasing experience, MitraClip® is a treatment that may be considered for severe FMR management even in advanced stages of HF including patients with Ch-CMP. Its role in PH-LHD treatment may depend on future prospective studies, the ideal moment of intervention before the condition becomes irreversible, as well as determining in which patients it would be a definitive treatment vs. a bridge for other therapies including HT and device therapy.

Lead author biography

Dr Juan Felipe Vasquez-Rodríguez is internal medicine specialist from the Universidad Militar Nueva Granada (Bogotá, Colombia) and Cardiology Fellow of the Cardioinfantil Foundation—Institute of Cardiology (Bogotá, Colombia).

Supplementary material

Supplementary material is available at *European Heart Journal - Case Reports* online.

Slide sets: A fully edited slide set detailing this case and suitable for local presentation is available online as Supplementary data.

Consent: The author/s confirm that written consent for submission and publication of this case report including image(s) and associated text has been obtained from the patient in line with COPE guidance.

Conflict of interest: none declared.

References

1. Moncayo A, Silveira AC. Current epidemiological trends of Chagas disease in Latin America and future challenges: epidemiology, surveillance, and health policies. *Mem Inst Oswaldo Cruz* 2009;**104** (Suppl 1):17–30.
2. Bestetti RB, Daniel R. The treatment of chronic heart failure secondary to Chagas cardiomyopathy in the contemporary era. *Int Cardiovasc Forum J* 2016;**7**.
3. Adamo M, Barbanti M, Curello S, Fiorina C, Chiari E, Chizzola G, Capodanno D, Tamburino C, Metra M, Ettori F. Effectiveness of MitraClip therapy in patients with refractory heart failure. *J Int Cardiol* 2015;**28**:61–68.

4. Dwivedi A, Vainrib A, Saric M. Functional mitral regurgitation in patients with heart failure and depressed ejection fraction. *Curr Opin Cardiol* 2016;**31**:483–492.
5. Patel H, Desai M, Tuzcu EM, Griffin B, Kapadia S. Pulmonary hypertension in mitral regurgitation. *J Am Heart Assoc* 2014;**3**.
6. Vachiéry J-L, Vonk-Noordegraaf A, Gibbs JSR, Rosenkranz S, Wachter R, De Marco T. Left ventricular heart failure and pulmonary hypertension. *Eur Heart J* 2015;**37**:942–954.
7. Mehra MR, Canter CE, Hannan MM, Semigran MJ, Uber PA, Baran DA, Danziger-Isakov L, Kirklin JK, Kirk R, Kushwaha SS, Lund LH, Potena L, Ross HJ, Taylor DO, Verschuuren EAM, Zuckermann A. The 2016 International Society for Heart Lung Transplantation listing criteria for heart transplantation: a 10-year update. *J Hear Lung Transplant* 2016;**35**:1–23.
8. Angelini A, Fedrigo M. Perioperative myocardial damage to the graft. In: *The Pathology of Cardiac Transplantation*. Cham: Springer International Publishing; 2016. p147–152. https://doi-org.ezproxy.umng.edu.co/10.1007/978-3-319-46386-5_9 (8 July 2019).
9. Parvathy UT, Rajan R, Faybushevich AG. Reversal of abnormal cardiac parameters following mitral valve replacement for severe mitral stenosis in relation to pulmonary artery pressure: a retrospective study of noninvasive parameters—early and late pattern. *Interv Med Appl Sci* 2016;**8**:49–59.
10. Gaemperli O, Moccetti M, Surder D, Biaggi P, Hurlimann D, Kretschmar O, Buehler I, Bettex D, Felix C, Luscher TF, Falk V, Grunenfelder J, Corti R. Acute haemodynamic changes after percutaneous mitral valve repair: relation to mid-term outcomes. *Heart* 2012;**98**:126–132.
11. Tigges E, Blankenberg S, von Bardeleben RS, Zuern C, Bekeredjian R, Ouarrak T, Sievert H, Nickenig G, Boekstegers P, Senges J, Schillinger W, Lubos E. Pulmonary hypertension and tricuspid valve regurgitation in patients undergoing transcatheter mitral valve repair. Results from the German transcatheter mitral valve interventions (TRAMI) registry. *Eur J Heart Fail* 2018;**20**:585–594.
12. Sankar NM, Ramani SS, Anantharaman R, Cherian KM. MitraClip and mitral annuloplasty device as a bridge to transplantation. *Asian Cardiovasc Thorac Ann* 2018;**26**:57–59.
13. Garatti A, Castelvecchio S, Bandera F, Medda M, Menicanti L. Mitraclip procedure as a bridge therapy in a patient with heart failure listed for heart transplantation. *Ann Thorac Surg* 2015;**99**:1796–1799.
14. Crimi G, Gritti V, Ghio S, Crescio V, Magrini G, Scelsi L, Turco A, Gazzoli F, Ferrario M, Raineri C, Oltrona Visconti L. MitraClip procedure as 'bridge to list', the ultimate therapeutic option for end-stage heart failure patients not eligible for heart transplantation due to severe pulmonary hypertension. *Pulm Circ* 2018;**8**.