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CONFLICTS OF INTEREST

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Circulatory Support With Extracorporeal Membrane Oxygenation System as a Bridge to Heart Transplantation in Complex Postinfarction Ventricular Septal Rupture

Asistencia circulatoria con oxigenador extracorpóreo de membrana como puente a trasplante cardiaco en rotura septal ventricular compleja

To the Editor,

The optimal timing for surgery to treat mechanical complications of acute myocardial infarction is still under debate.[1]

Postinfarction ventricular septal defect (VSD) is an infrequent complication associated with high mortality. The actual incidence of this condition ranges from 0.17% to 0.31%, with a mortality of 94% with medical treatment and 42.5% with surgery.[1] The variables associated with greater mortality are age, need for early surgery, size > 12 mm, and posterior site.[2]

Recently, the potential use of circulatory support systems as a bridge to definitive correction of postinfarction VSD or even as a bridge to heart transplantation has been reported.[3]

This article presents the first reported experience in Spain of extracorporeal membrane oxygenation (ECMO) as a bridge to heart transplantation in a patient with 2 mechanical complications of myocardial infarction: a large posterior VSD and left ventricular pseudoaneurysm.

The patient was a 62-year-old man with hypertension and type 2 diabetes mellitus. He presented with a 14-hour history of oppressive chest pain.

The electrocardiogram showed Q waves with 2-mm ST elevation in the lower leads and 1.5-mm ST depression in the lateral leads. Blood pressure was 110/50 mmHg and he had sinus tachycardia at 120 bpm. On physical examination, a pansystolic III/VI murmur was noted at the left sternal border.

Emergent coronary angiography was performed using the right radial artery approach. This showed involvement of the right coronary system with complete occlusion of the mid segment of the right coronary artery (Figure 1A). Left ventriculography showed an undilated left ventricle (LV), with inferior akinesia and a posterior spherical cavity filled with contrast in the same phase as the LV, and subsequent passage of contrast to the right ventricle (Figure 1B and video in the supplementary material). An intra-aortic balloon pump was implanted. Echocardiography revealed an undilated LV with a large VSD (Figure 2A) at the level of the posterior and basal segments of the septum, with left-right flow and diameters of 30 x 23 mm. The ventricular wall also showed severe thinning in these segments consistent with pseudoaneurysm. Neither pericardial effusion nor valve disease was observed, and right ventricular function was preserved.

Given the large extent and the posterior site of the VSD, the lesion was considered surgically irreparable. It was therefore decided to implant an ECMO device as circulatory support using the left femoral artery approach. The patient was placed on a waiting list for heart transplantation with top priority (Figure 2B). On the third day, successful heart transplantation was performed without any complications. The patient's postoperative recovery was free of complications and he was discharged after 15 days.

Study of the explanted heart confirmed the diagnoses; a large VSD was observed in the basal and posterior part of the septum and, related to this, a posterior pseudoaneurysm within the visceral pericardium (Figure 2B).

This article presents the first reported experience in Spain of ECMO device implantation as a bridge to heart transplantation in an unusual case with 2 mechanical complications of myocardial infarction considered surgically irreparable. ECMO is used increasingly frequently in situations of refractory cardiogenic shock[4] and as circulatory support for high-risk coronary intervention.[5] Recently, the feasibility of implanting such devices in the catheterization laboratory has been reported.[6]

We believe that the use of this type of peripheral circulatory support in complex mechanical complications of myocardial infarction such as large VSD in our present patient is preferable to longer-term ventricular assist devices, as the procedure is less

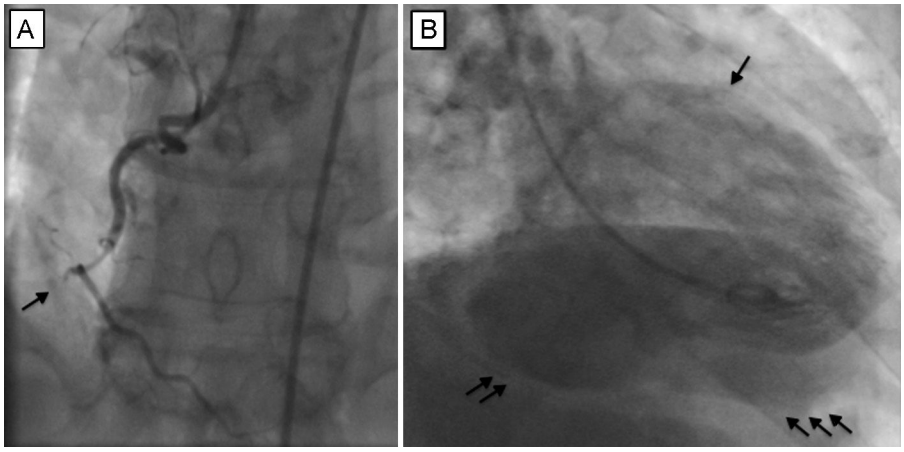

Figure 1. A: Right coronary artery occluded in the mid segment (arrow). B: Ventriculogram; left ventricle (single arrow), pseudoaneurysm (double arrow), and right ventricle (triple arrow).

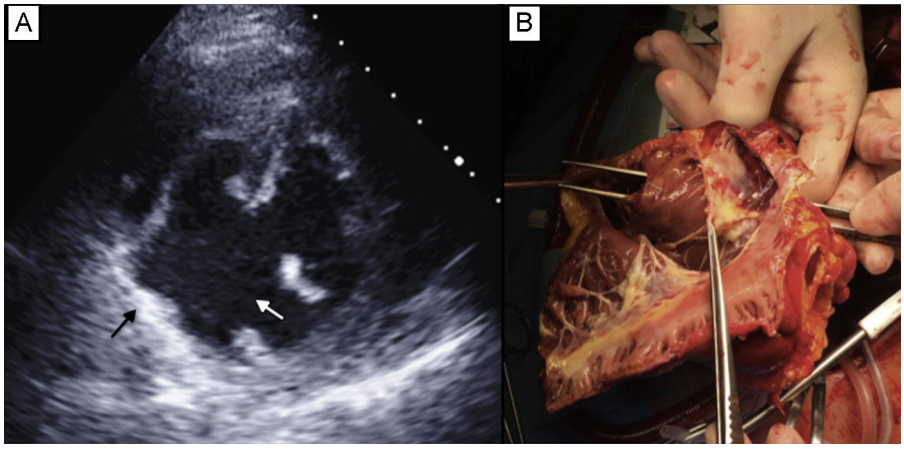

Figure 2. A: Echocardiogram showing the ventricular septal defect (white arrow) and pseudoaneurysm (black arrow). B: Explanted heart; the right ventricle is open and tweezers introduced through the aortic valve pass through a large ventricular septal defect in the posterior part of the septum.

aggressive and avoids the effects of suction and flow loss. Advantages of this device associated with use of balloon counterpulsation include decreased myocardial oxygen requirements, which in the present case could have helped prevent an increase in the size of the infarction and VSD. In addition, a lower pressure at the ventricular wall could have reduced the risk of a localized rupture becoming a tear. Finally, the device can buy time until transplantation or a less risky repair if this were possible. Other possibly therapeutic options include the Impella ventricular assist device or a total artificial heart (Cardiowest).[1]

Our case, although subject to the limitations inherent in a single observation, indicates that the use of circulatory support in the form of an ECMO device as a bridge to transplantation is an alternative to surgical repair in cases of large postinfarction VSD or when 2 or more mechanical complications are present after infarction. Further study is needed to analyze the specifics of the outcomes of both strategies.

SUPPLEMENTARY MATERIAL

Supplementary material associated with this article can be found in the online version available at doi:10.1016/j.rec.2016.02.015.

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Real-world Data on the Efficacy of Vernakalant for Pharmacological Cardioversion in Patients With Recent-onset Atrial Fibrillation

Eficacia en nuestro entorno del vernakalant para la cardioversión farmacológica del paciente con fibrilación auricular de reciente comienzo

To the Editor,

Atrial fibrillation (AF) is the most common cardiac arrhythmia and the reason for many emergency department (ED) visits.[1] The treatment of AF in the ED is a challenge the recommended approach is conversion to sinus rhythm (SR).[2] Rhythm control is normally achieved with propafenone and flecainide in patients without structural heart disease and with amiodarone in those with structural heart disease. Nevertheless, given the difficulty of ruling out a history of structural heart disease, intravenous amiodarone is frequently used in the ED, although it is not considered the best choice for conversion to SR. Vernakalant is a new antiarrhythmic multichannel blocking agent intended for intravenous administration with a short half-life (2 hours) and high selectivity for atrial cardiomyocytes. It is recommended for conversion in patients with AF of less than 7 days duration, moderate structural heart disease, and the only contraindications are severe hypotension (< 100 mmHg), heart failure (New York Heart Association functional class III-IV), severe aortic stenosis, or acute coronary syndrome within 30 days.[2,3] Given the benefits of the drug, we began to use it in the our ED according to the recommendations on dosage and infusion times and the summary of the product characteristics.[4] We present our experience of the first 52 consecutive administrations of vernakalant between January 2014 and December 2015. We collected information on risk factors, the presence of structural heart disease, duration of AF, time from start of infusion to conversion to SR, adverse effects, and length of stay in the ED.

In total, 47 patients were included in the study. Of these patients, 5 received vernakalant during 2 ED visits, making a total of 52 treatments. Table 1 shows the patients' baseline characteristics. Conversion was achieved in 45 patients (86%) and a second vernakalant infusion was needed in only 8 patients. In addition, the time to conversion to SR was rapid (mean, 12.5 minutes; range, 1-115; median, 8), which led to shorter stays in the ED (mean, 5.3 [2-18] hours). Five patients experienced mild adverse events: 1 patient had sustained ventricular tachycardia (vernakalant infusion was maintained with subsequent conversion to SR); 2 patients had self-limiting cough and nausea; 1 patient had dysgeusia; and 1 patient had self-limiting atrial flutter. Regarding its use with other antiarrhythmic agents, conversion was attempted with amiodarone in 1 patient, without success, and at 4 hours an infusion of vernakalant achieved conversion within a few minutes. Another patient received background therapy with flecainide to which vernakalant was added without incident. Vernakalant was used more frequently with beta-blockers (10 patients) than with dihydropyridine calcium antagonists (1 patient).

Binary logistic regression analysis was used identify predictors of success in conversion to SR with vernakalant (Table 2). Elevated heart rate on the first electrocardiogram at arrival was independently associated with successful conversion, whereas the presence of structural heart disease was associated with low success rates.

This study demonstrates the efficacy of vernakalant in achieving rapid and safe conversion to SR. Only 5 patients experienced mild transient adverse effects and the mean conversion time was 12.5 minutes, which allowed patients to be discharged from the ED in just over 5 hours.

The results of our series are better than those of pivotal trials of vernakalant, which together show an efficacy of 51%[3] although, as in our series, conversion was rapid and safe. Nevertheless, the results of its use in clinical practice are very similar to ours. Demonstrated efficacy rates of 86% to 93% and of 66% have been published by Conde et al[3] and Mochalina et al[5], respectively. The analysis of predictors of success showed that elevated heart rate was associated with the highest success rates. However, in line with the findings of Costabel al,[6] the presence of structural heart disease was nonsignificantly associated with low success rates. This finding may explain why the results of registries are better than those of pivotal trials, given that the proportion of patients with structural heart disease is lower in real-world registries.

The main limitations of this study are its single-center design and its small sample size, which may have decreased its statistical power to identify predictors of successful conversion. In addition, the patients were relatively healthy, had a low prevalence of structural heart disease, and had a first AF episode. In contrast, the percentage of patients with a first AF episode was lower in clinical trials and other published real-world studies.

In conclusion, vernakalant is an efficacious, rapidly acting, and safe drug for conversion of AF to SR. The main limitations to its

Table 1
Baseline Characteristics of the 47 Patients

Age, y	66 (24-89)
Male sex	23 (49)
Hypertension	28 (60)
DM	3 (6)
Structural heart disease	8 (17)
IHD	3 (6)
Heart failure	1 (2)
Rheumatic mitral valve disease	3 (6)
Hypertrophic cardiomyopathy	1 (2)
CHA_2DS_2-VASc score	2.3 (0-6)
First AF episode	37 (79)
Duration, h	8.2 [1-118; 4]
Heart rate during AF, bpm	133 (81-176)

AF, atrial fibrillation; DM, diabetes mellitus; IHD, ischemic heart disease.
Data are expressed as no. (%) or mean [range; median].

Table 2
Independent Predictors of Conversion to Sinus Rhythm Using Vernakalant (Binary Logistic Regression)

Variable	OR (95%CI)	*P*
Sex	0.492 (0.058-4.168)	.516
History of heart disease	0.163 (0.021-1.274)	.084
Heart rate during AF	1.056 (1.004-1.111)	.034
Duration of AF	0.988 (0.937-1.042)	.657
Age	1.018 (0.945-1.097)	.642

95%CI, 95% confidence interval; AF, atrial fibrillation; OR, odds ratio.