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Percutaneous balloon atrial septostomy for treating heart failure

Septostomía atrial percutánea con balón en el tratamiento de la insuficiencia cardíaca

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To the Editor,

The epidemic of heart failure is spreading throughout the world. In this prestigious journal, Jerez Castro[1] made an exhaustive and accurate review of the availability of non-pharmacological alternatives for the treatment of heart failure; however, this disease keeps a high morbidity and mortality, decreases life quality and increases hospital admissions and health care costs.

In the pathophysiology of the different forms of presentation of pump failure: either acute or chronic, and heart failure with preserved ejection fraction (HFpEF) or reduced ejection fraction (HFrEF), there is a common element: increased left atrial (LA) pressure. The creation of an interatrial communication through percutaneous balloon atrial septostomy (PBAS) has emerged as an alternative therapy.

In patients with cardiogenic shock treated with veno-arterial extracorporeal membrane oxygenator, with refractory pulmonary edema, PBAS is an option for left ventricular (LV) decompression[2]. This improves the edema, subendocardial perfusion and oxygen consumption, but the impact on clinical outcomes is difficult to establish due to the limited number of patients.

In chronic heart failure more evidence is available. The creation of a small, restrictive, interatrial septal communication ensuring unidirectional left-to-right flow is used in patients in New York Heart Association (NYHA) functional class III/VI, despite optimal medical treatment[2,3]. The theoretical benefit is extrapolated from the natural history of the small congenital atrial septal defect, which reduces the LA pressure without compromising cardiac output nor producing right ventricular failure or severe pulmonary hypertension.

The best hemodynamic results of the shunt are achieved with defects between 8 and 12 millimeters, where pulmonary capillary pressure decreases both at rest and during physical exercise. In HFpEF there is a rapid impairment of life quality and hospital admissions. This stimulates the search for invasive therapies such as the creation of an interatrial septal communication, where the LA pressure decreases and the right-sided heart accommodates to the volume overload. Bauer *et al.*[3] demonstrated that, in these patients, performing PBAS has palliative effects, with a decreases in: LV filling pressure, pulmonary congestion and B-type natriuretic peptide levels.

In the context of LV systolic dysfunction and in another study with 22 patients with dilated cardiomyopathy awaiting heart transplantation, this same author and her collaborators[4] performed PBAS between 7 and 14 mm, and managed to decrease mean

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LA pressure (initial 15.8±6.8 vs. 12.2±4.8 mmHg post-procedure, p=0.005), thereby achieving functional recovery in 14 patients without the need for mechanical circulatory support device[4].

The benefit of this PBAS technique led to the rapid development of interatrial implantation devices that maintain and regulate flow patency. The Interatrial Shunt Device (IASD) System II consists of a 1-piece, self-expanding metal cage that has a double-disc design with an 8 millimeter opening orifice (barrel) in the center. It reduced pulmonary capillary pressure at rest and on physical exercise, with a Qp/Qs ratio of 1.27 at six-months follow-up in patients with HFrEF[5]. The safety of this device was demonstrated in a randomized clinical study, with a reduction in pulmonary capillary pressure, without the occurrence of major adverse events during the procedure or in the long term[6].

Another device, the V-Wave one, that is also self-expandable, with an internal diameter of 5.1 mm and no right-to-left flow —which theoretically reduces the possibility of paradoxical embolism— was evaluated by Rodés-Cabau *et al.*[7] in 38 patients with heart failure (97% in NYHA functional class III and 79% of ischemic cause) and they achieved a reduction in symptoms on exertion as well as improvement in LV systolic function (EF 23.7% to 26.8%, p=0.007), without any death, stroke, embolization device or infection and only one case presented cardiac tamponade.

In the HFrEF scenario, the first experience with the V-Wave[8] demonstrated improvement at three-month follow-up in the following parameters:

- Clinical: NYHA functional class (p=0.0004), Duke activity status index (p=0.016) and six-minute walk test (p=0.016).
- Echocardiographic: LV end-diastolic (p=0.031) and end-systolic volume (p=0.01).
- Hemodynamic: cardiac output (p=0.011), cardiac index (p=0.02), pulmonary capillary pressure (p= 0.035) and mean blood pressure (p=0.027).

In a recent publication, Simard *et al.*[9] propose access to the LA through the coronary sinus in order to preserve the atrial septum for future interventions as well as to decrease the risk of paradoxical embolism. Percutaneous atriotomy from the coronary sinus with implantation of a device that guarantees flow patency is a viable procedure with good clinical and hemodynamic results.

At the *Hospital Clínico-Quirúrgico Hermanos Ameijeiras* in Havana, Cuba, a research protocol is being developed in patients with chronic heart failure and poor functional class, with optimal medical treatment and no indication for other invasive therapy. The PBAS is performed as a palliative measure to reduce LA pressure, improve symptoms and reduce hospitalizations. In the cases where it was performed, after the puncture of the interatrial septum, 10 and 12 millimeter balloon dilation is sequentially performed and the LA pressure drop is verified (**Figure**). The clinical evolution has been favorable and no major adverse events associated to the procedure have been reported.

The treatment of heart failure, in addition to reducing mortality, focuses on reducing hospitalizations and the disease burden related to symptoms limiting physical activity. The creation of an interatrial communication offers a new therapeutic approach.

CONFLICT OF INTERESTS

None declared.

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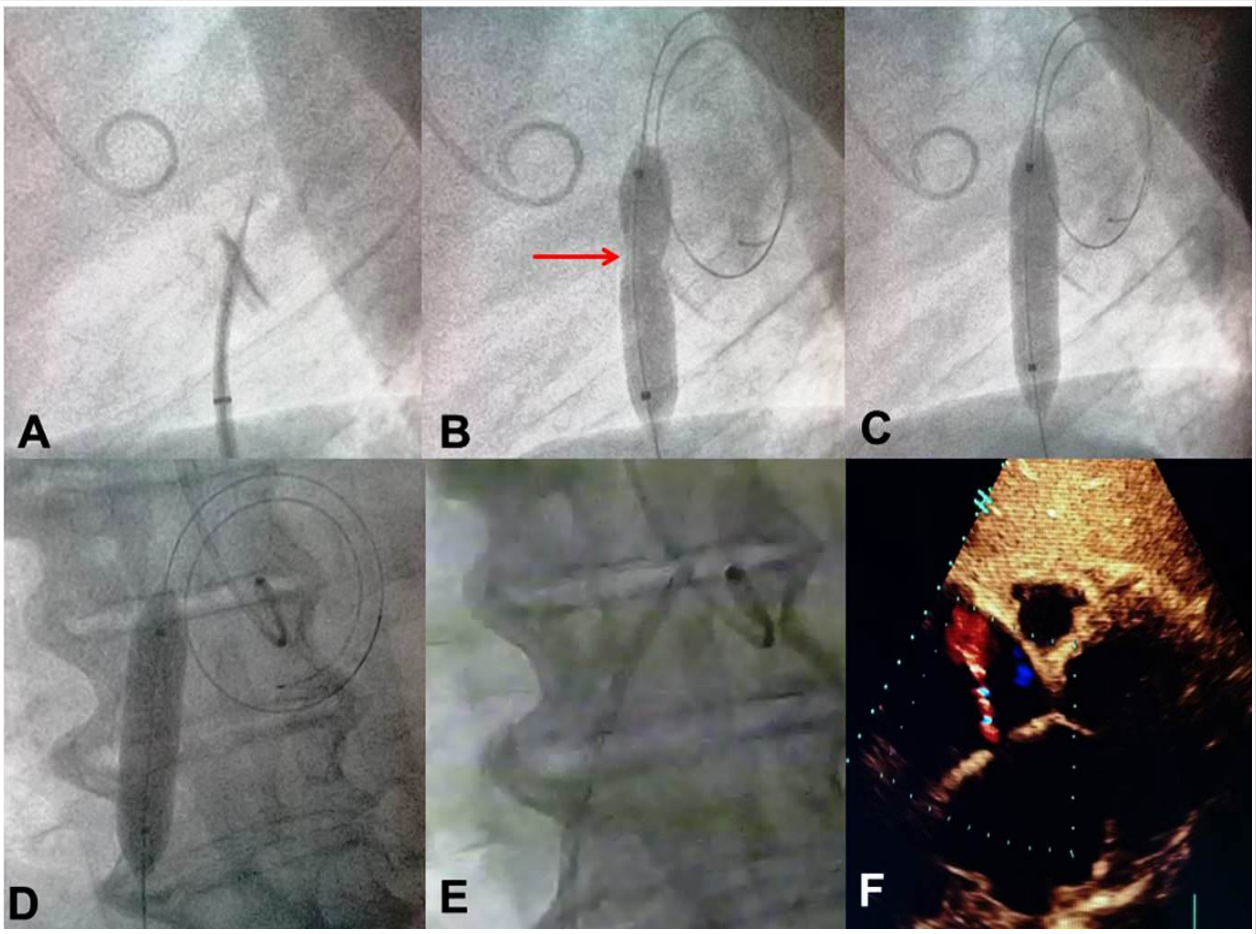

Figure. Description of the technique in images. **A**. Transseptal puncture with a Brockenbrough needle. **B-C**. Dilation with 10-millimeter diameter balloon. The red arrow points to the balloon waist which coincides with the interatrial septum. **D**. Fully insufflated 12-millimeters balloon. **E**. Left atrial pressure measurement. **F**. Echocardiogram showing the small communication at the interatrial septum with left-to-right shunt.

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