Severe hemolysis after transapical closure of mitral perivalvular leak requiring transeptal reintervention

Hemólisis severa postcierre de leak perivalvular mitral por vía transapical que requirió reintervención por vía transeptal

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ABSTRACT

Congestive Heart Failure and hemolysis are the most common presentation of perivalvular leaks. We report a case of transapical closure of a Mitral perivalvular leak in a patient with Heart Failure who lately developed severe hemolysis due to a small residual defect and high-velocity jet, and its reintervention using transeptal approach.

Keywords: *mitral valve, hemolysis, mitral perivalve leak.*

RESUMEN

Las manifestaciones más frecuentes de las fugas perivalvulares son la insuficiencia cardíaca (IC) y la hemólisis. Reportamos un caso de cierre de leak perivalvular mitral por vía transapical, en paciente con síntomas de insuficiencia cardíaca que posteriormente desarrolló severa hemólisis secundaria a fuga residual pequeña con jet de alta velocidad y su reintervención posterior por vía transeptal.

Palabras claves: *válvula mitral, hemólisis, leak mitral perivalvular.*

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INTRODUCTION:

Paravalvular leaks (PVL) occur in between 6% and 15% of valve replacement surgeries. They are most common in the mitral compared to the aortic position and their occurrence is traditionally associated with conditions such as tissue friability, calcification or infections. (1,2) The presence of moderate or severe PVL after surgical or percutaneous valve replacement is associated with a higher mortality rate. (3)

In cases of moderate or severe regurgitations the usual clinical sign is heart failure. Small PVLs capable of producing high-velocity jets can cause hemolytic anemia as the main clinical sign. (4) Infectious endocarditis has also been reported as an unusual presentation sign.

The anatomical conditions that predispose to the development of PVL complicate its future surgical resolution. On the other hand, these patients have a high risk of reintervention since the presence of heart failure or severe hemolysis compromises their general state of health. In this context, interest on the transcatheter approach has been growing as a possible therapy for the management of PVL closure.

This is the case of a paraseptal mitral PVL closure via transapical access in a symptomatic patient with heart failure who developed severe hemolysis due to small residual leakage that required reintervention via transseptal approach.

CLINICAL CASE

Seventy-two-year-old male patient with HBP, type-2 diabetes, previous myocardial infarction with left main coronary artery disease and 3-vessel disease with moderate-to-severe heart failure of mixed etiology. The patient underwent coronary artery bypass graft surgery and mitral valve replacement with a 29-mm biologic prosthesis without complications. Three months later the patient presents with progressive dyspnea and signs of congestive heart failure. The echo-Doppler study performed confirmed the presence of a paravalvular leak related mitral regurgitation (grade 3

The patient progresses to heart failure of complicated pharmacological management and is hospitalized due to hemodynamic decompensation. The percutaneous closure of the defect is scheduled, and a transesophageal echocardiography (TEE) is performed followed by a volume CT scan (figure 1).

Given the paraseptal location of the leak the transapical access was used under general anesthesia with orotracheal intubation and transesophageal probe insertion. The left ventricular apex is accessed through an incision in the 5th left intercostal space, anterior axillary line, following the parameters seen on the CT scan assessment. The apex is then punctured using an 18-gauge guidewire followed by the insertion of a 6-Fr introducer sheath (Cordis). A 5-Fr JR catheter (Cordis) is advanced under radioscopic and ultrasound guidance towards the location of the defect, which is crossed until the left atrium is reached with a 0.032 in hydrophilic guidewire (Terumo). A 9-Fr Occlutech introducer sheath is advanced. Then, an HTFII coronary guidewire (Abbott) is left across the defect as a protective measure anticipating the eventual loss of the position already reached. The Occlutech PLD (14W) device is inserted into the sheath. The first disc is advanced towards the left atrium, the left ventricular sheath is removed, and a second disc in deployed in the left ventricle. The good results are confirmed when fewer regurgitation is seen on the TEE, which is why it is decided to release the device (figure 2). The procedure is completed with surgical hemostasis without further complications. The patient is released from the hospital 3 days after the surgery.

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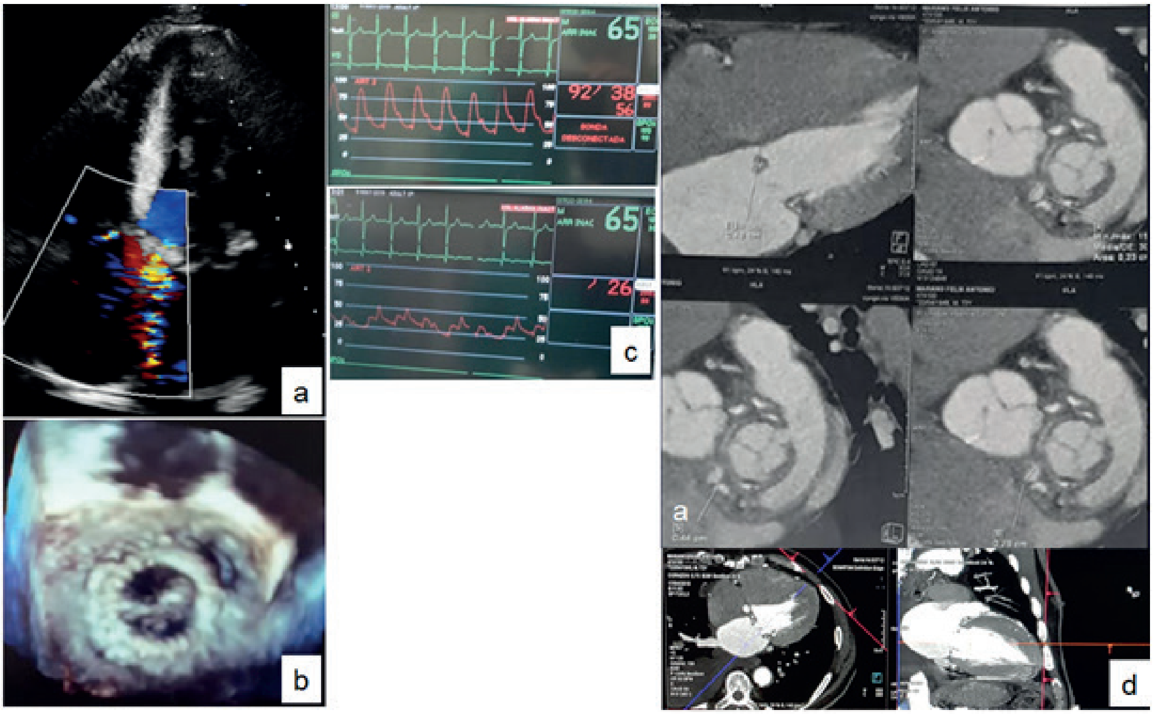

Figure 1. *Assessment prior to the closure of the leak via transapical access. a) Echo-Doppler study: Paraseptal mitral regurgitation jet. b) 3D TEE "en face": leak of 12 mm maximum diameter in hour 2. c) Hemodynamic repercussion: PAP, 92/38 (56) mmHg; PCWP, 26 mmHg; V wave, 54 mmHg. d) Volume CT scan: assessment of the leak and transapical access.*

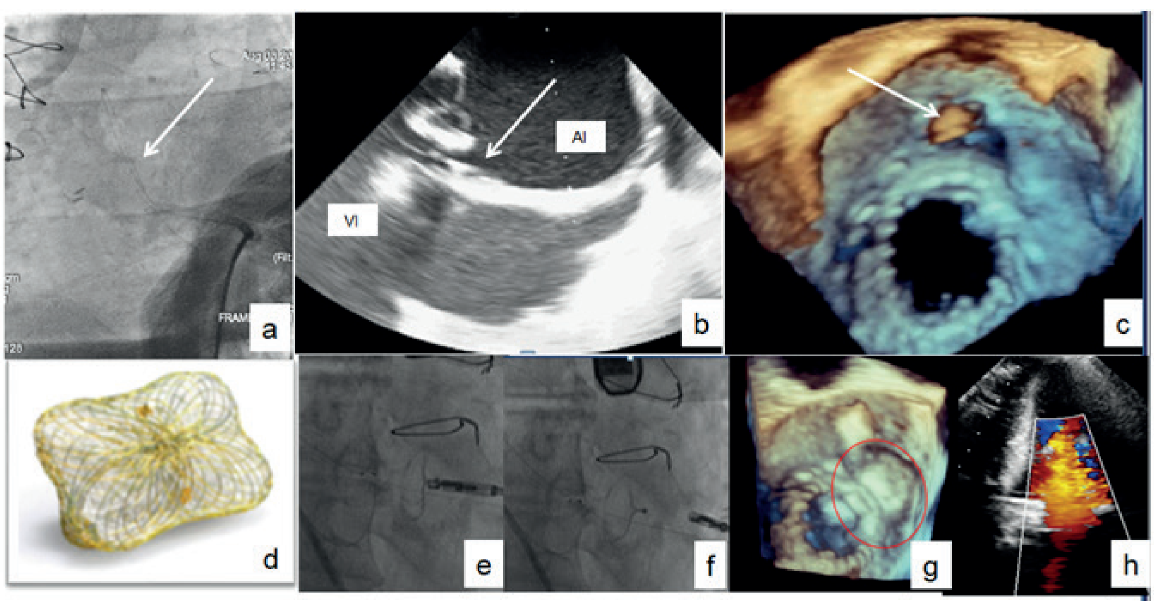

Figure 2. *Leak closure via transapical access. a and b) Radioscopy and TEE: HTF2 guidewire crossing the defect (arrow) from the LV towards the LA. c) c) 3D TEE "en face" confirming the guidewire passage (arrow) through the leak. d) Occlutech PLD (14 W) occluder device. e) Device connected to the delivery system. f) Device delivered. g) 3D TEE "en face": properly positioned device (circle). h) Echo-Doppler study: fewer leak. AI: left atrial. VI: left ventricle.*

The patient progression after discharge is good and the dose of diuretics is gradually lowered. Forty-five days after the procedure, the patient presents with dyspnea, asthenia, and weight loss. These are the levels obtained from the lab tests: hematocrit, 18%; hemoglobin, 6.4 grs/dL; total bilirubin, 4.27 mg/dL; direct bilirubin, 2.46 mg/dL; indirect bilirubin, 1.82 mg/dL; haptoglobin, 4 mg/dL. The clinical signs are interpreted as intravascular hemolytic anemia.

The echo-Doppler study performed confirms the presence of a small residual leak with high-velocity regurgitant jet. Within the next few weeks, the patient is polytransfused showing progressive impairment of her general state. Two TEE and volume CT scan assessments are performed to schedule the reintervention. The exact location of the defect is found between the ventricular disc of the device previously implanted and a calcified portion of the mitral annulus (figure 3).

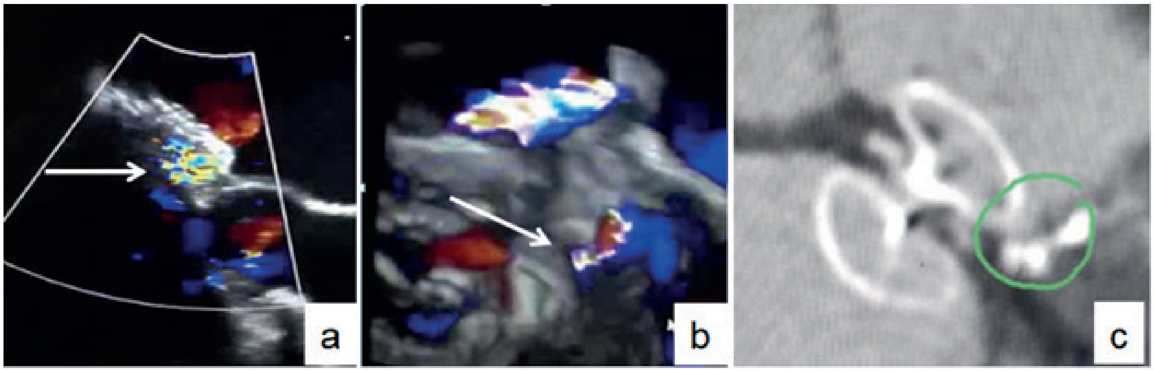

Figure 3. *Identification of high-velocity residual jet on the TEE and volume CT scan. a) TEE: high-velocity jet causing aliasing (arrow). b)3D color TEE: regurgitant jet peri-device previously implanted (arrow). c) Volume CT scan: precise identification of the leak site in relation to the calcified portion of the mitral annulus.*

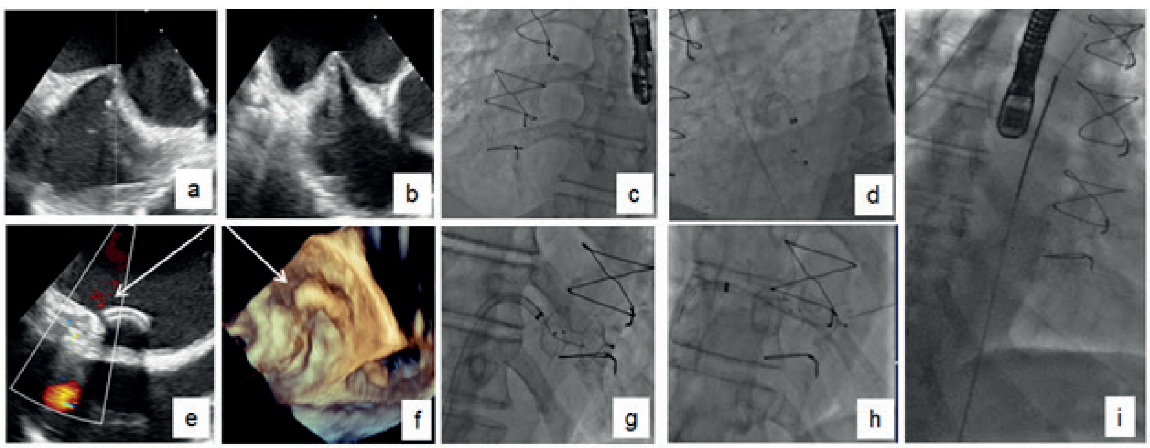

Figure 4. *Reintervention via transapical access. a) and b) TEE: bicaval and short axes, respectively. Tenting on the interatrial septum. c) and d) Fustar deflectable sheath in neutral position and maximum flexion, respectively. e) and f) Position of the Fustar sheath close to the defect seen on the 2D and 3D TEE, respectively (arrows). g) and h) Command 18-gauge guidewire crossing the defect. i) After capturing the Command guidewire with the snare in the LV, the wireis thenadvanced towards the aorta and retrieved through the femoral artery sheath.*

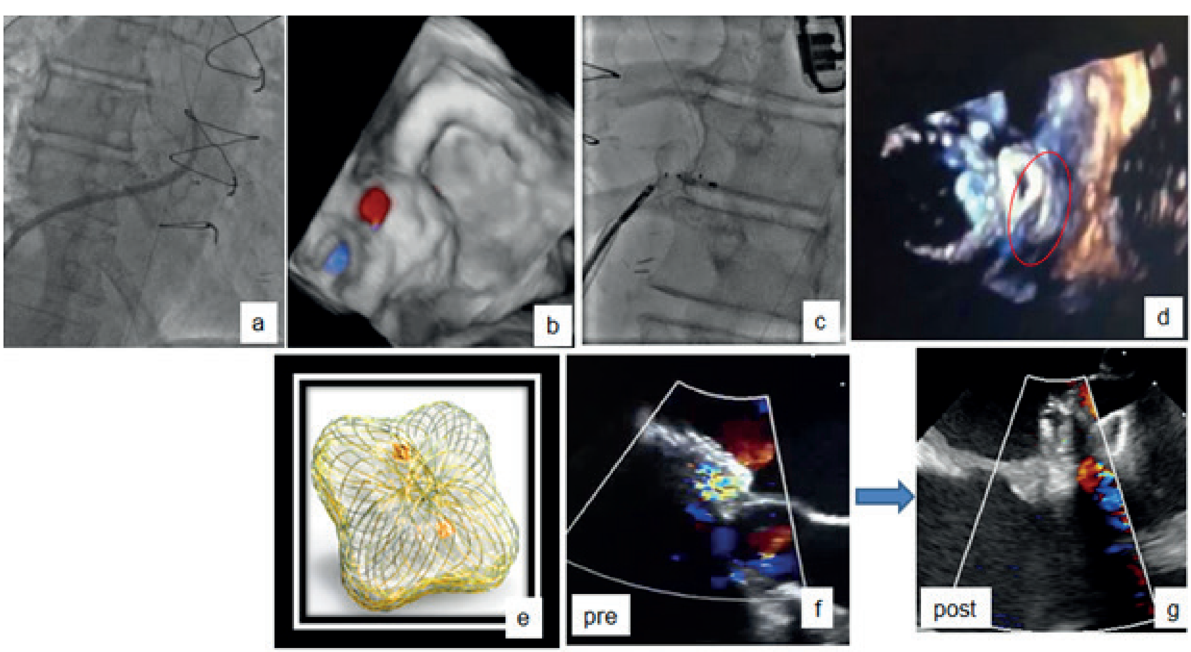

Figure 5. *Reintervention through transseptal access (cont). a) 9-Fr Occlutech introducer sheath crossing the defect. b) The 3D color TEE confirms the crossing of the sheath outside the device previously implanted. c) OcclutechPLD 5T occluderdevice in position prior to release. d) The 3D TEE confirms the right position of the occluderdevice. e) Occlutech PLD 5T occluder device. f)and g) Flow comparison through the defect before and after completing the procedure, respectively.*

Due to the deterioration of the patient general state and despite the unfavorable location of the defect, it is decided to avoid the transapical access again and change it for the transseptal approach.
The right femoral vein is punctured under general anesthesia. A transseptal puncture is performed under TEE guidance using a Brockenbrough needle and selecting the posterior-superior portion of the interatrial septum. An 8-Fr Fustar deflectable introducer sheath (Lifetech) is advanced towards the left atrium. Using anticlockwise rotation and a maximum deflection maneuver, the wire distal edge is positioned close to the defect based on the images obtained on the 3D TEE. After several attempts a Command 18-gauge, 300 cm guidewire (Abbott) is successfully advanced towards the left ventricle. Several devices (4-Fr JR and MP catheters and OTW balloons) are unsuccessfully mounted over the guidewire. Afterwards, the femoral artery is punctured and a 6-Fr introducer sheath (Cordis) is inserted and advanced towards the left ventricle. There, the Command-18 guidewire is captured and retrieved through the arterial introducer (figure 4). Thanks to the support obtained a delivery system with a 9-Fr sheath is advanced towards the left ventricle. The Occlutech PLD 5T device was advanced inside the sheath and parallel to the guidewire. Then, the sheath was retracted, and the ventricular and atrial discs were eventually deployed. The TEE confirms the total cessation of flow through the leak, and the device is eventually released (figure 5).
The procedure was completed without further complications. The in-hospital progression of the patient was uneventful, and he was discharged after 48 hours.
In the follow-up after hospital discharge and 30-day lab test results, the patient clinical improvement is confirmed with improved anemia and hemolysis parameters: hematocrit, 29%; total bilirubin, 0.55 mg/dL; direct bilirubin, 0.23 mg/dL, indirect bilirubin, 0.32 mg/dL.

DISCUSSION:

The case described leaves us a few reflections to make:
Assessment through multimodal imaging modalities (echo-Doppler, TEE, 3D, volume CT scan, and radioscopy) is an essential part in the diagnosis and treatment of PVL. Therefore, and as it occurs with the management of other structural heart diseases, interventional cardiologists trained in the aforementioned multimodal imaging are key for the management of this heart disease (5).
Paraseptal mitral PVLs are a tremendous technical challenge due to the difficulties involved when using transseptal access. In our patient, this meant that the early intervention was performed through transapical access. However, before the reintervention and due to the greater clinical impairment experienced by the patient, we decided to try the transseptal access first. Thus, given the satisfactory result obtained through this access route, we can conclude that the most challenging locations (such as paraseptal leaks) can be accessed via transseptal approach. The acquisition of the right kind of images in the cath lab (3D TEE), the availability of materials (deflectable sheaths, guidewires, snares, etc.), and the technical management of such materials facilitate the use of transseptal access first in virtually every location.
The percutaneous closure of PVLs is often described as successful when it brings regurgitation down to grade ≤ 1 in the absence of complications. This result is obtained in between 70% and 90% of the cases and the percentage is higher the more experienced the operator is. Currently, technical success rates close to 90% have been reported (6.7). Although a significant reduction of regurgitation was achieved during the first intervention bringing it down to degree ≤1, the case reported here conditioned the development of severe hemolytic anemia that deteriorated the patient quickly and led to a reintervention some time later. Therefore, although in patients PVL who develop heart failure the target is to bring regurgitation down to grade ≤1, it seems reasonable to think that we should not underestimate clinical significance that can be caused by high-velocity residual jets.

CONCLUSIONS:

As it occurs with the management of other structural heart diseases, the diagnosis and planning of the percutaneous management of PVLs requires training in multimodal imaging methods for the interventional cardiologist.
The closure of paraseptal mitral PVLs poses a technical challenge. Defects found in this location can be accessed using the transapical or transseptal approach. The latter is an attractive access route to reduce morbidity in critically ill patients, but it requires the use of specific materials and advanced technical skills.
Finally, the lowest possible degree of regurgitation should be aimed at to guarantee a favorable clinical progressi

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