CASE REPORT
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Valve in TAVR: surgical explantation of transcatheter aortic valve

Válvula en TAVR: explantación quirúrgica de la válvula aórtica transcatéter

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ABSTRACT

Aortic stenosis is the most common valve disease in the population. The treatment of excellence has been surgical valve replacement. In recent years, new prostheses have been developed for patients at high surgical risk through the transcatheter approach. We present the case of a man who underwent transcatheter valve replacement; five years later, he developed febrile symptoms that did not remit with antibiotic therapy. After the studies performed, the transcatheter device was surgically explanted due to prosthetic infective endocarditis.

Keywords: transcatheter aortic valve replacement, TAVR associated infective endocarditis, surgical explantation of TAVR.

RESUMEN

La estenosis aórtica es la valvulopatía más frecuente en la población. El tratamiento de excelencia ha sido la sustitución valvular quirúrgica. En los últimos años se han desarrollado nuevas prótesis para pacientes con riesgo quirúrgico alto a través de abordaje transcatéter. Presentamos el caso de masculino quien se sometió a reemplazo transcatéter; cinco años después desarrolla cuadros febriles que no remiten ante antibioticoterapia. Después de estudios realizados, se realiza explantación quirúrgica de dispositivo transcatéter por endocarditis infecciosa protésica.

Palabras clave: *reemplazo valvular aórtico transcatéter, endocarditis infecciosa asociada a TAVR, explantación quirúrgica de TAVR.*

Aortic stenosis (AS) is the most prevalent valve disease worldwide.[1] Their prevalence increases with age. The prevalence is important mainly in the elderly. It affects 0.2% of people between 55 and 64 years of age and about 2-7% of those over 65 years of age. Given that the prevalence increases as the population ages, it is expected to increase in the coming years. By 2030, it is estimated that approximately 4.5 million people will suffer from this valve disease.[2]

The etiology is mainly due to congenital and acquired causes. The most common cause of acquired AS is degenerative. It is mainly due to calcification and thickening of the aortic valve which reduces flow.[3] Congenital bicuspid aortic valve hinders blood flow, which increases the development of early AS and calcification.[1] Typically, the aortic valve area normally measures 3.0 to 4.0 cm^2.[2] When a significant reduction of the valve orifice area below 1.5 cm^2 occurs, an increase in transvalvular gradient is generated.[3]

Treatment consists of a choice between surgical aortic valve replacement (SAVR) or transcatheter aortic valve replacement (TAVR). Surgical risk stratification of the patient plays an important role in the management that the patient will receive in this pathology. Identification of patient risk status is performed using the Society of Thoracic Surgeons-Predicted Risk of Mortality (STS-PROM).[4] SAVR has been

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the standard for treating severe and symptomatic AS for a long time, although in the last decade the transcatheter technique has been implemented.[5] SAVR is recommended in younger patients who are at low risk for surgery.

TAVR has taken relevance as management for patients with AS who are inoperable or who are at high (> 8%) or intermediate (> 4%) risk according to STS-PROM.[6] Its preference is recommended above all in older patients (> 75 years) and especially in patients at high risk (STS-PROM > 8%) or unsuitable for surgery. As in SARV, the characteristics of each patient should be considered, such as: previous cardiac surgery, especially in cases where there are coronary artery bypass grafts that may be injured during repeated sternotomy, elderly patients with severe fragility, assessment of the possibility of an adequate transfemoral approach or the condition of the aorta (porcelain aorta).[7]

Due to the increase in TAVR, it is important to consider the possible complications that may occur after the procedure. Five common periprocedural complications have been described that affect the long term after transcatheter valve replacement. The five complications mainly described are stroke, acute renal failure, moderate to severe paravalvular leakage, vascular complications, and conduction disturbances.[8]

In recent years, the indications for the use of TAVR have expanded, which has led to an increase in the number of complications. TAVR-associated infective endocarditis (TAVR-IE) is an uncommon complication, but is associated with high morbidity and mortality.[9] Regarding the comparative occurrence of TAVR-IE or in SAVR, in an analysis of the PARTNER 1 and PARTNER 2 trials, the incidence and mortality in both groups were analyzed. The incidence of occurrence was similar in both groups, presenting 4.10 cases per 1,000 person-years in the SARV group, while in the TAVR group it was 5.21 cases per 1,000 person-years.[10]

With regard to the TAVR-IE presentation, there is little concrete information on its presentation. There is growing interest in infections occurring after TAVR. Kaur, et al[9] in their single center cohort study analyzed risk factors, microbiological patterns and assessed the average time in which TAVR-IE developed. They established the time of onset of the disease according to early (one year) onset, as well as the predominant risk factors and microbiological patterns. In the cohort studied, ten of the 494 cases studied corresponded to TAVR. The incidence was predominantly in women. The presentation according to temporality was intermediate onset in 60% of the cases. The most common organism isolated was staphylococcus aureus in 66.6% of the cases. Mortality was present in 40% of the cases. In patients with early and intermediate onset it was 25% and in the late-onset group it was 100%.[9]

CASE DESCRIPTION

76-year-old male patient with a history of pacemaker implantation 17 years ago secondary to third-degree atrioventricular block. 5 years ago with a diagnosis of severe aortic stenosis (severe aortic stenosis (valve area 0.65 cm^2). Percutaneous implantation of Core Valve Evolut R 24 mm aortic valve was performed.

The current condition started one year ago with febrile episodes of up to 41 °C. He received private care with empirical antibiotic treatment with partial improvement in one month. After this first febrile condition, presented again different symptoms that required multiple hospitalizations, receiving various antibiotic regimens without clinical improvement. Seven months after the onset of symptoms, he presented febrile symptoms accompanied by adynamia and weight loss of 10 kg. Cultures were taken and staphylococcus sanguinis was reported, and antibiotic schedules with levofloxacin and clindamycin were started. Subsequently, he presented new febrile symptoms, performing cultures in particular media, with no isolated pathogen.

A transesophageal echocardiogram was performed in which vegetation attached to the electrode crossing the tricuspid valve was observed in the right atrium. It presents motility, occasionally entering the right ventricular cavity and measures 31 × 17 mm with an area of 4.6 cm^2. At the

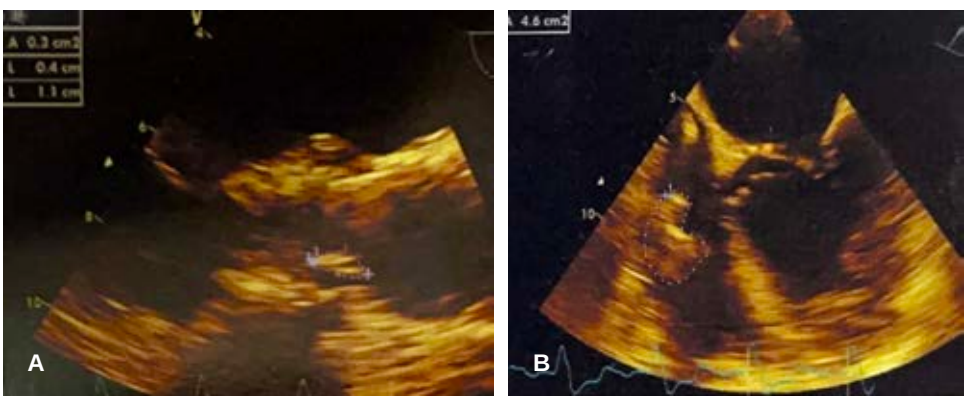

Figure 1:

Preoperatory ecocardiogram. A) Image suggestive of vegetation in mechanical prosthesis in aortic position of probable periaortic abscess of anterior location. B) Image suggestive of vegetation attached to ventricular pacemaker electrode crossing tricuspid valve.

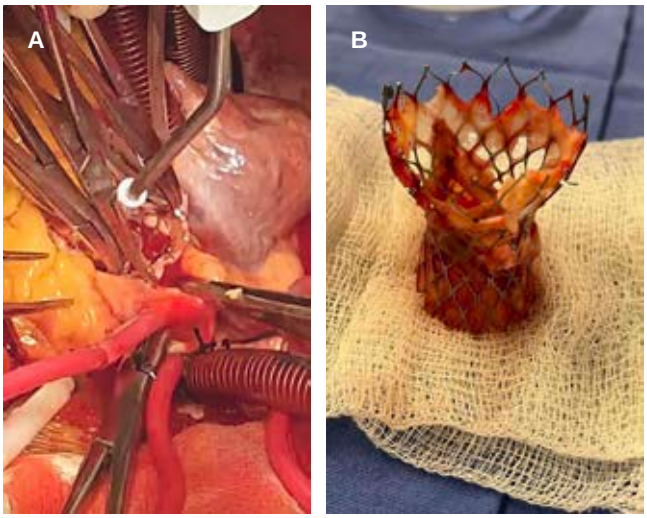

Figure 2: A) Intraoperative image demonstrating collapse of the distal nitinol frame of the prosthesis supported by circumferential placement of Kelly clamps. B) Transcaterer prosthesis (Core Valve type) explanted with evidence of endothelialization throughout its frame.

level of the aortic prosthesis there is an image suggestive of vegetation extending into the anterior portion of the aortic root suggesting a probable periaortic abscess, on Doppler analysis with no evidence of rupture *(Figure 1)*. Severe left ventricular dysfunction was reported, left ventricular ejection fraction of 29%, so it was decided to perform cardiothoracic surgery.

For surgical resolution, a median sternotomy approach was performed. Pericardial opening and marsupialization of the edges is performed. The pericardial was opened and subsequent marsupialization of edges. Purse-string is placed in the aorta, right atrium and right superior pulmonary vein for cannulation. Subsequently, aortic clamping was performed and cardioplegia was administered until electromechanical arrest. For the resection of the valve prosthesis, aortotomy was performed, finding the valve prosthesis in aortic position. The prosthesis is removed. Four kelly smith clamps are placed circumferentially on the nitinol frame for collapse *(Figure 2A)*. Once the distal end of the prosthesis has collapsed, careful blunt dissection of the remainder of the prosthesis from the aortic wall is performed. The prosthesis was fully explanted *(Figure 2B)*. Post-extraction remodeling of the valve site is identified. The native valves were resected and decalcification of the annulus was performed. A PTEF felt patch is placed over the aortic annulus and a 2-0 ethibond valve suture is placed. Edwards lifesciences perimount magna ease aortic biological valve number 25 mm is measured, descended and knotted. After valve replacement, the distal pacemaker leads are removed. The distal portion of the leads were successfully removed and a definitive epicardial pacemaker was placed. Raffia and subsequent aortic unclamping is performed. Decannulation and cessation of extracorporeal circulation without complications. Hemostasis, drainage placement, and plane closure are verified. Extracorporeal circulation time was 152 minutes and aortic clamping time was 115 minutes. A total of 20,000 IU of heparin and 324 mg of protamine are used.

After surgery, required 11 days of hospitalization, without complications. Two months later, a control echocardiogram was performed. A normal functioning mechanical prosthesis was reported, with adequate mobility of the valve, without the presence of masses or thrombi adhered to its surface. Without presence of paravalvular leak. Maximum gradient 17 mmHg.

COMMENT

Aortic stenosis is one of the most prevalent valve diseases worldwide. Due to this, the development of new devices and techniques for its treatment is essential. Transcatheter aortic replacement is a less invasive option that is preferred to be performed in high surgical risk patients with valvular disease. The treatment of choice has been based on surgical replacement of the valve through median sternotomy or through minimally invasive techniques. The new valve replacement management options have been adapted more frequently in most cardiovascular care centers and to the population. It is preferred in elderly patients with high and intermediate surgical risk, with adequate anatomy.[9]

We present the first case of transcatheter device explantation in our institution. The development of endocarditis in the post-TAVR setting is feared and rare. In a 2020 review by Ostergaard, et al[11] reported the incidence to be between 0.7-3.0% per person per year. Fifty percent or more of patients presenting with TAVR-IE had surgical indication, only 16.4% or less underwent resolutive surgery.

The surgical explantation of aortic valve bioprostheses is increasing and its clinical impact is substantial in patients who require it. It is of great importance to assess the clinical and stability of the patient at the time of diagnosis of TAVR-IE. In surgery for transcatheter valve explantation, the possible damage and anatomical modification that the area has undergone must be analyzed. This leads the cardiothoracic surgeon to face scenarios of uncertainty and requires difficult decisions to be made when treating these patients.

In a retrospective case study by Fukuhara, et al[12] where they analyzed surgical explants of transcatheter bioprostheses. Seventeen patients were included. Once the data were analyzed, the indications for explantation were found to be: the main paravalvular leak in seven patients (41.2%), followed by structural valve degeneration in 4 (23.5%), valve migration in 2 (11.8%), intraoperative coronary obstruction in 2 (11.8%), prosthetic valve endocarditis in 1 (5.9%). Postoperative mortality was 11.8%. This retrospective review provides important information regarding the surgical

technique used in the different explants. It is important to mention that this review not only describes the surgical technique for explantation due to endocarditis, but also deals with explantation due to different etiologies. This provides a comprehensive overview of the appearance of the valve at the time of its removal. All explants were performed in a single center. The approach was via median sternotomy, regardless of whether concomitant cardiac surgery was required. The aortotomy was oblique or transverse. The instrument that was essential for the surgery consisted of the use of a Kocher clamp. The use of the clamp made it possible to keep the nitinol frame compressed by means of a crushing maneuver to facilitate extraction. Depending on the time of implantation, different compromises of the anatomy were found. In prostheses implanted < 6 months, there were few adhesions at the level of the stent frame and the aorta. Their release was achieved by eliminating the radial force of the prosthesis to the annulus using a Kocher clamp. No damage to the aortic annulus, anterior mitral leaflet or left ventricular outflow tract was identified. In prostheses older than 1-year, aortic neo endothelialization was observed throughout the prosthesis. The prosthetic leaflets were heavily calcified. Endothelialization predominated at the aortic root and sinotubular junction. Release of the prosthesis required endarterectomy to separate the prosthesis from the aortic wall.

Several techniques have been described in the literature on retro transcatheter prosthesis. Of the first reports in the literature is the one described by Albes,[13] he describes the removal due to paravalvular leak. He proposes that after aortotomy, the prosthesis should be bluntly dissected. After widening the access, a braided suture is passed through the nitinol frame in the form of a tobacco pouch and a tourniquet is placed, "tourniquet technique" *(Figure 3)*. In this technique, when the tourniquet is placed, it collapses the frame and allows easier manipulation of the rest of the prosthesis.

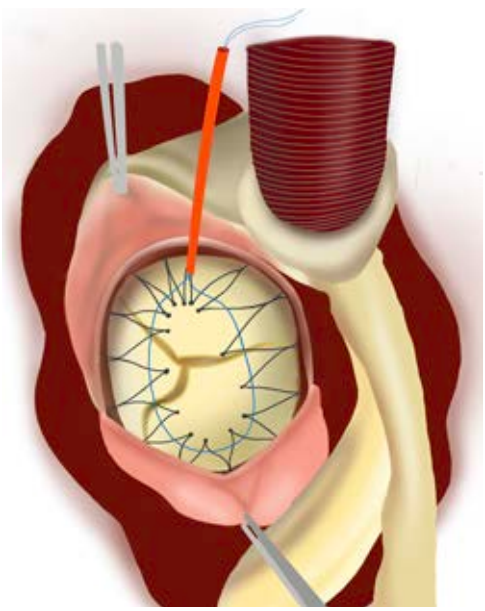

Figure 3: Graphical representation of the "tourniquet technique" for valve prosthesis collapse.

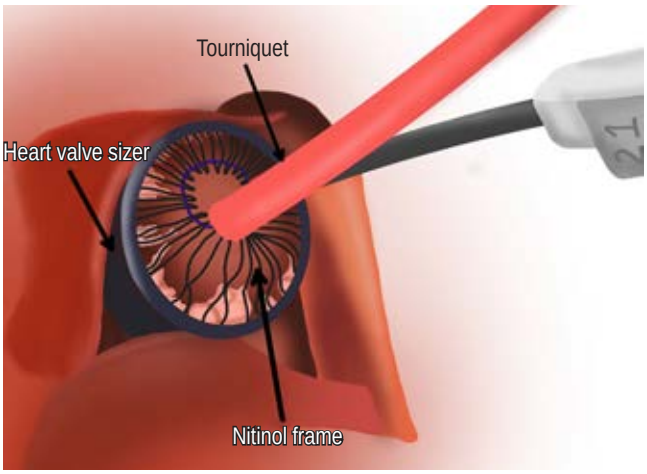

Figure 4: Graphic representation of the "heart valve sizer technique" for transcatheter valve prosthesis explantation.

Another more recent publication by Corona, et al[14] proposes a technique of explantation with the support of heart valve sizer. This case report presents a 68-year-old male patient with a diagnosis of critical stenosis in whom a transcatheter aortic prosthesis was placed. This report corresponds to the first case of transcatheter prosthesis explantation in Mexico. At six months follow-up, the patient presented severe paravalvular leakage requiring explant of the prosthesis 137 days after its placement. It was replaced by a biological prosthesis surgically. The proposed technique consists of using a circumferential suture through the nitinol frame and with the support of a tourniquet the distal end of the prosthesis is collapsed. For the extraction, a heart valve sizer was slid in. This allowed a progressive collapse of the annular portion, "heart valve sizer technique" *(Figure 4)*.

CONCLUSIONS

According to this literature, explantation of transcatheter prostheses is a challenge for the cardiothoracic surgeon. Most of the techniques described did not involve endocarditis of the prosthesis as in our case. With respect to our case, the development of endocarditis in our case occurred five years, 1971 days after transcatheter prosthesis placement. During explantation in our case, Kelly smith forceps were used. The attachment of the proximal portion and the advanced neo endothelialization process made its extraction difficult. The

objective of exposing various techniques of transcatheter prosthesis explantation, allows us to know the possibility of techniques that we can use. Although we do not have a standard norm for explantation, knowing what has been done allows us to have shortcuts for future cases. Each case must be individualized and the surgeon must use the tools at his disposal at the appropriate time depending on the modification of the anatomy involved. In our case, the advanced process of endothelialization and remodeling of the valvular site was a challenge. In addition, the time since prosthesis placement was a factor against facilitating explant.

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