Case Report

Aortic Valve-in-Valve in a Patient with Infective Endocarditis after COVID-19 Infection: A Case Report

Azin Alizadeasl, MD[1], Seifollah Abdi, MD[2], Ata Firouzi, MD[2], Hamidreza Pouraliakbar, MD[3], Parham Sadeghipour, MD[2], Rasoul Azarfarin, MD[1], Niloufar Akbari Parsa, MD[4*]

[1]*Cardio-Oncology Research Center, Rajaie Cardiovascular Medical and Research Center, Iran University of Medical Sciences, Tehran, Iran.*
[2]*Cardiovascular Intervention Research Center, Rajaie Cardiovascular Medical and Research Center, Iran University of Medical Sciences, Tehran, Iran.*
[3]*Cardiovascular Imaging Department, Rajaie Cardiovascular Medical and Research Center, Iran University of Medical Sciences, Tehran, Iran.*
[4]*Cardiovascular Diseases Research Center, Department of Cardiology, Heshmat Hospital, School of Medicine, Guilan University of Medical Sciences, Rasht, Iran.*

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Abstract

Few cases of transcatheter aortic valve implantation (TAVI) following infective endocarditis (IE) have been reported. In this presentation, we discuss the feasibility of TAVI in a degenerated bioprosthetic valve affected by IE.

We examine a rare case involving an elderly man with a degenerated bioprosthetic aortic valve complicated by IE 6 months after a COVID-19 infection. The patient was successfully treated with valve-in-valve intervention following antibiotic therapy for the acute phase of the infection. This resulted in excellent outcomes with no complications in the early postprocedural period and during follow-up visits.

For patients with a destructed bioprosthetic aortic valve due to IE and residual dysfunction after healing, valve-in-valve intervention can be a safe and effective treatment option, particularly for those at high risk for surgery.

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Introduction

Transcatheter aortic valve implantation (TAVI) has become a well-established therapeutic option for patients with severe aortic stenosis who are considered at prohibitive risk for open-heart aortic valve replacement.[1] However, when the aortic valve is damaged due to infective endocarditis (IE), TAVI may be a potential therapeutic option,[2] although few cases have been reported in the medical literature on the use of TAVI following IE, and even fewer on TAVI-in-valve procedures after IE.[1]

[*]**Corresponding Author:** ***Niloufar Akbari Parsa,*** *Assistant Professor of Cardiology, Cardiovascular Diseases Research Center, Department of Cardiology, Heshmat Hospital, Mosalla Sq, Rasht, Iran. 4193955588. Cell: +98 9113359748. Tel: +98 13 33669066. Fax: +98 13 33668718. E-mail: dr.niloufar.parsa@gmail.com.*

Case Report

An 88-year-old man presented to our center with progressive dyspnea, fatigue, and chills over the preceding month, as well as loss of appetite and weight loss in the past 2 weeks. Upon presentation, he had a blood pressure of 126/48 mm Hg, a heart rate of 80 bpm, a respiratory rate of 16 breaths/min, an O_2 saturation level of 92% in ambient air, and a body temperature of 37.8 °C. A physical examination revealed a grade III/VI systolic and diastolic murmur at the right sternal border, decreased lung sounds in both lungs, and bilateral lower limb peripheral edema.

The patient lived alone and was able to work independently until the previous month. His medical history included hypertension and AV replacement with a bioprosthesis 18 years prior due to severe stenosis. Six months before the presentation, he was diagnosed with COVID-19 pneumonia, from which he recovered within a month. His current medications included aspirin, furosemide, and valsartan.

Last month, the patient was admitted to another medical center with dyspnea. He was diagnosed with degenerative changes in his aortic bioprosthesis. During that hospitalization, he experienced acute kidney injury and was discharged with a creatinine level of 2.3 mg/dL.

Laboratory data at the time of admission to our center showed the following: a white blood cell count of 5300 cells/mm³ with 85% neutrophils, a hemoglobin level of 10.6 g/dL, a creatinine level of 2.5 mg/dL, an erythrocyte sedimentation rate of 85 mm/h, and a C-reactive protein level of 3+. In the following days, blood cultures were negative on 3 occasions, and urine and stool cultures as well as tests for Brucellosis were also negative.

ECG demonstrated normal sinus rhythm. Both transthoracic echocardiography (TTE) and transesophageal echocardiography (TEE) revealed severe left ventricular enlargement with an ejection fraction of 50%–55%, mild right ventricular dilation with moderate dysfunction, severe posterior mitral annular calcification with mild stenosis, and severe primary and moderate diastolic mitral regurgitation (MR). The AV was found to be calcified, destructed, perforated, and flail, with significant stenosis and severe free regurgitation. Multiple hypermobile masses were observed, with the largest measuring approximately 1 cm. Systolic pulmonary artery pressure was estimated to be around 85 mm Hg. Premature closure of the mitral valve, diastolic MR, and elevated left ventricular end-diastolic pressure collectively pointed toward a diagnosis of acute aortic regurgitation (Figure 1). (Also see additional Video File 1, which demonstrates the TEE procedure. It shows multiple hypermobile vegetations on aortic bioprosthesis with severe stenosis and severe regurgitation.)

The patient was prescribed adjusted doses of vancomycin,

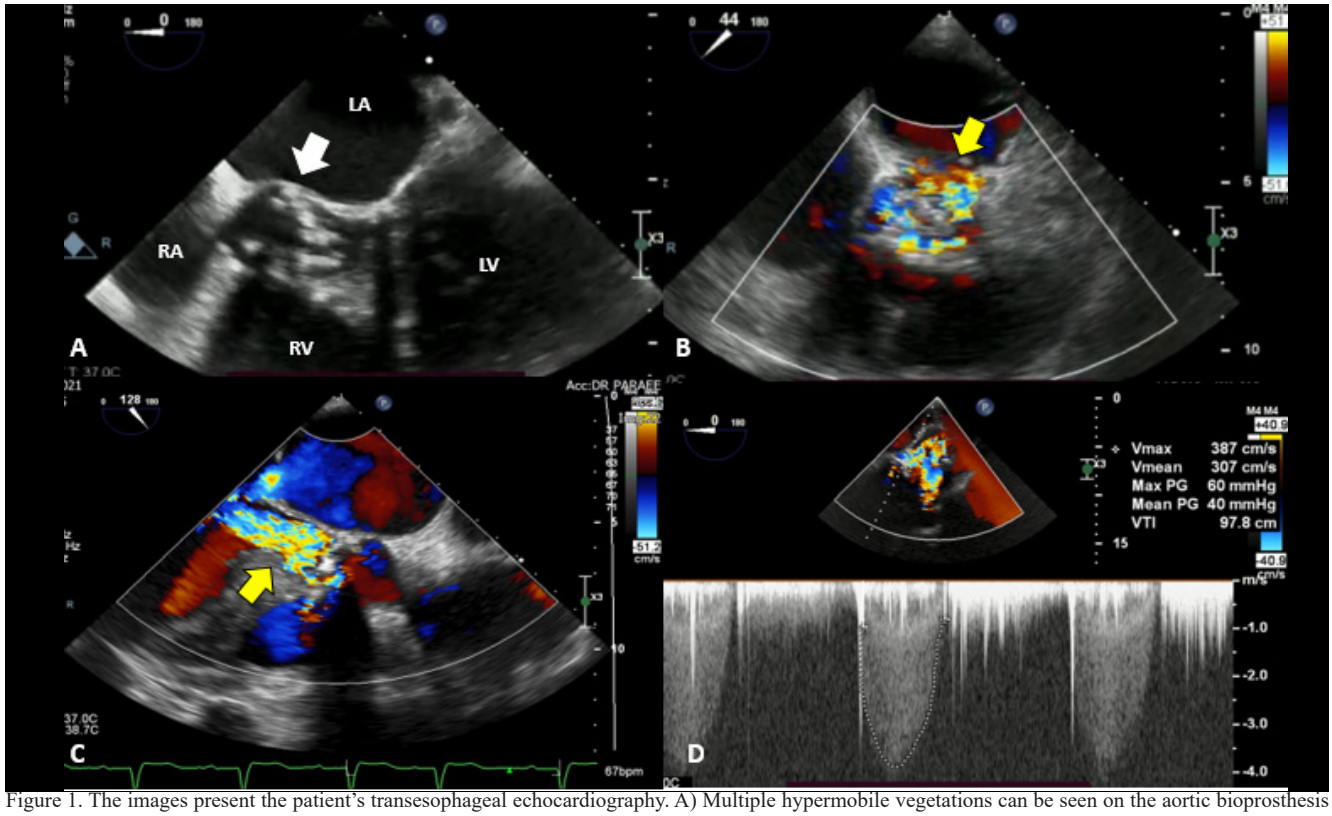

Figure 1. The images present the patient's transesophageal echocardiography. A) Multiple hypermobile vegetations can be seen on the aortic bioprosthesis (the white arrow). B & C) The images show severe regurgitation of the aortic bioprosthesis (the yellow arrow). D) Continuous Doppler study demonstrates severe degenerative changes of the aortic valve, resulting in severe aortic stenosis with a peak gradient of 60 mm Hg and a mean gradient of 40 mm Hg. LV, Left ventricle; RV, Right ventricle; LA, Left atrium; RA, Right atrium

ampicillin/sulbactam, and gentamicin as empirical therapy for IE with negative cultures, although it is important to note that the negative blood cultures may have been due to antibiotic treatment during his previous admission. Abdominal ultrasound and brain computed tomography revealed no evidence of splenic abscesses or mycotic aneurysms. Following a 6-week course of antibiotic therapy, he was discharged.

Despite improvement in fever, fatigue, and appetite, the patient continued to experience dyspnea. After consultation with the heart team and discussions with the patient and his family, it was determined that he was at high risk for surgery. Therefore, an aortic valve-in-valve procedure was scheduled.

Cardiac computed tomography angiography estimated the AV annulus perimeter to be approximately 2.25 cm (Figure 2). The patient's previous bioprosthesis was a Mitroflow Synergy size 25. Cardiac catheterization demonstrated mild coronary artery disease and a 60 mm Hg peak-to-peak gradient across the AV. Based on the computed tomography and TEE data, an Evolut R valve size 26 was selected for the valve-in-valve procedure. Several challenges were encountered during the procedure, including a sigmoid-shaped interventricular septum base, the absence of an opaque marker on the previous bioprosthesis in fluoroscopy, and numerous mobile particles, particularly a large one situated near the left main coronary artery ostium. Consequently, a guidewire was placed in the left main artery with a stent on standby in case of any embolization or compromise, and a pigtail marker was utilized at the non-coronary cusp. Additionally, balloon and guidewire markers were drawn upon to determine the optimal implantation site. The valve was successfully implanted. (Figure 3). (Also see Video & Supplemental Video 2, demonstrating the fluoroscopy of the valve-in-valve procedure.) The entire procedure was guided by TEE. After the procedure, the left ventricular ejection fraction was 55%, the AV peak gradient decreased to 18 mm Hg, and the mean gradient dropped to 12 mm Hg with mild paravalvular leakage. Furthermore, there was no diastolic MR, although moderate primary MR was observed, and the systolic pulmonary artery pressure decreased to 45 mm Hg (Figure 4). (Also see additional Video File 3, which demonstrates the intraprocedural TEE following valve implantation, showcasing the proper positioning of the valve.) ECG showed normal sinus rhythm without an atrioventricular block.

Fortunately, the vegetations were effectively trapped behind the device frame, preventing cerebral, distal, or coronary embolization. The patient regained full consciousness within a few hours and was discharged

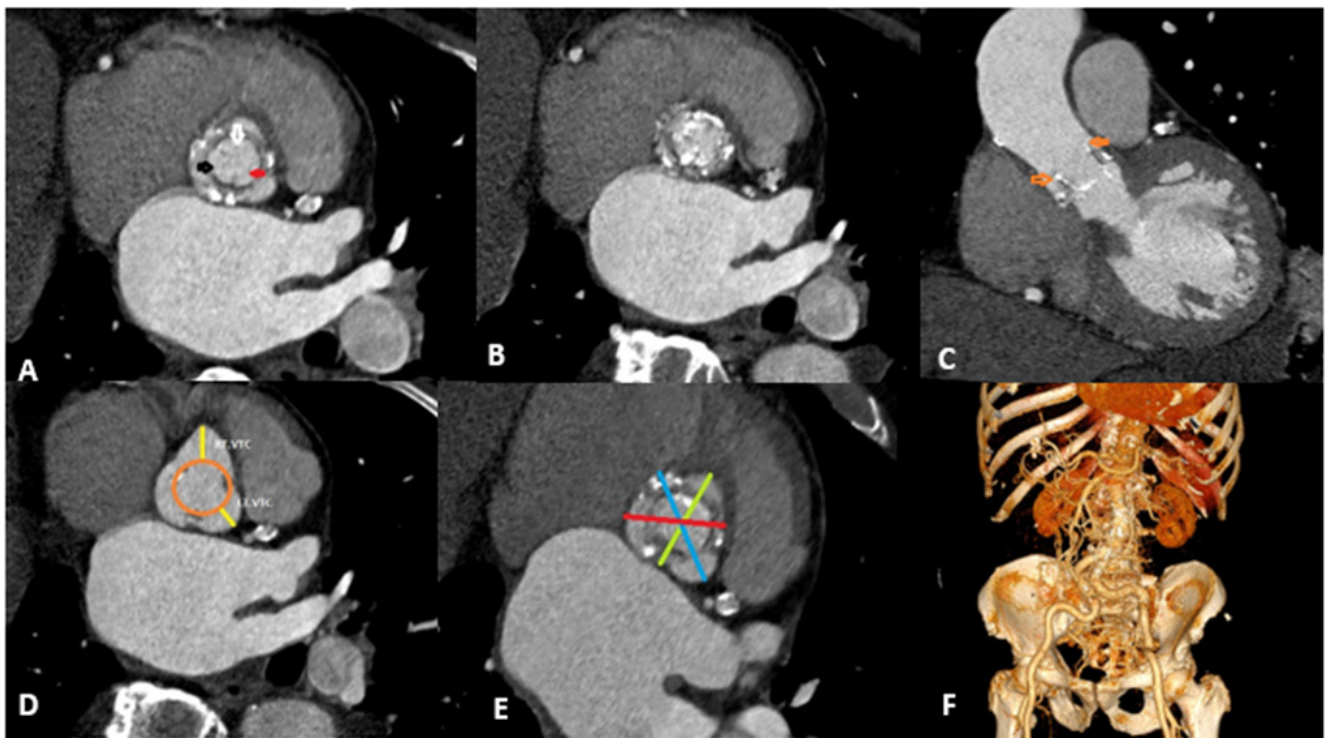

Figure 2. The images illustrate the patient's retrospective ECG-gated cardiac computed tomography (multiplanar reconstruction). A) The image displays the right leaflet (the white arrow), the left leaflet (the red arrow), and the non-coronary leaflet (the black arrow), as well as the calcification of the leaflets. B) The coronal view shows the struts (the orange arrows) of the bioprosthetic valve. C) The coronal view continues to show the struts (the orange arrows) of the bioprosthetic valve. D) The cross-sectional view of the aortic bioprosthesis shows the distance from the origin of the left and right coronary arteries (the yellow lines) to the virtual valve (the orange circle), referred to as the virtual valve to coronary distance. E) The axial view at the level of coronary sinuses represents the width of the right sinus of Valsalva (the green line), the left sinus of Valsalva (the blue line), and the non-coronary sinus of Valsalva (the red line). F) The volume-rendered image demonstrates the abdominal aorta and the bilateral iliac arteries.

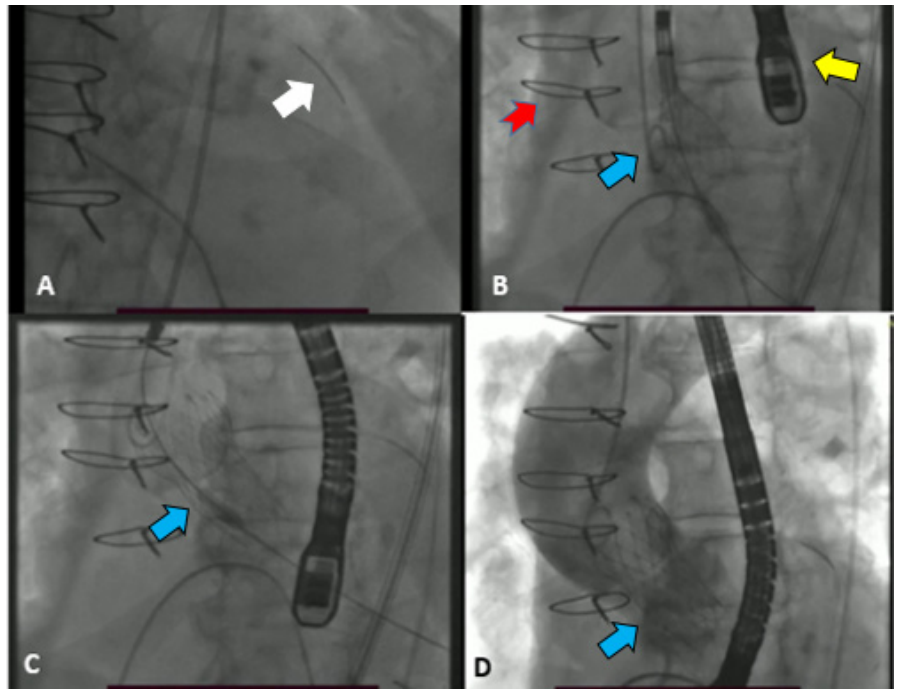

Figure 3. Fluoroscopic images from the valve-in-valve procedure are presented herein. A) A guidewire was placed in the left anterior descending artery (white arrow), and a stent was kept on standby. B & C) The aortic valve (blue arrow) was successfully implanted. The red notched arrow indicates the previous sternotomy wires, while the yellow arrow points to the transesophageal echocardiography probe. D) Aortic root injection demonstrates correct valve positioning with no significant regurgitation.

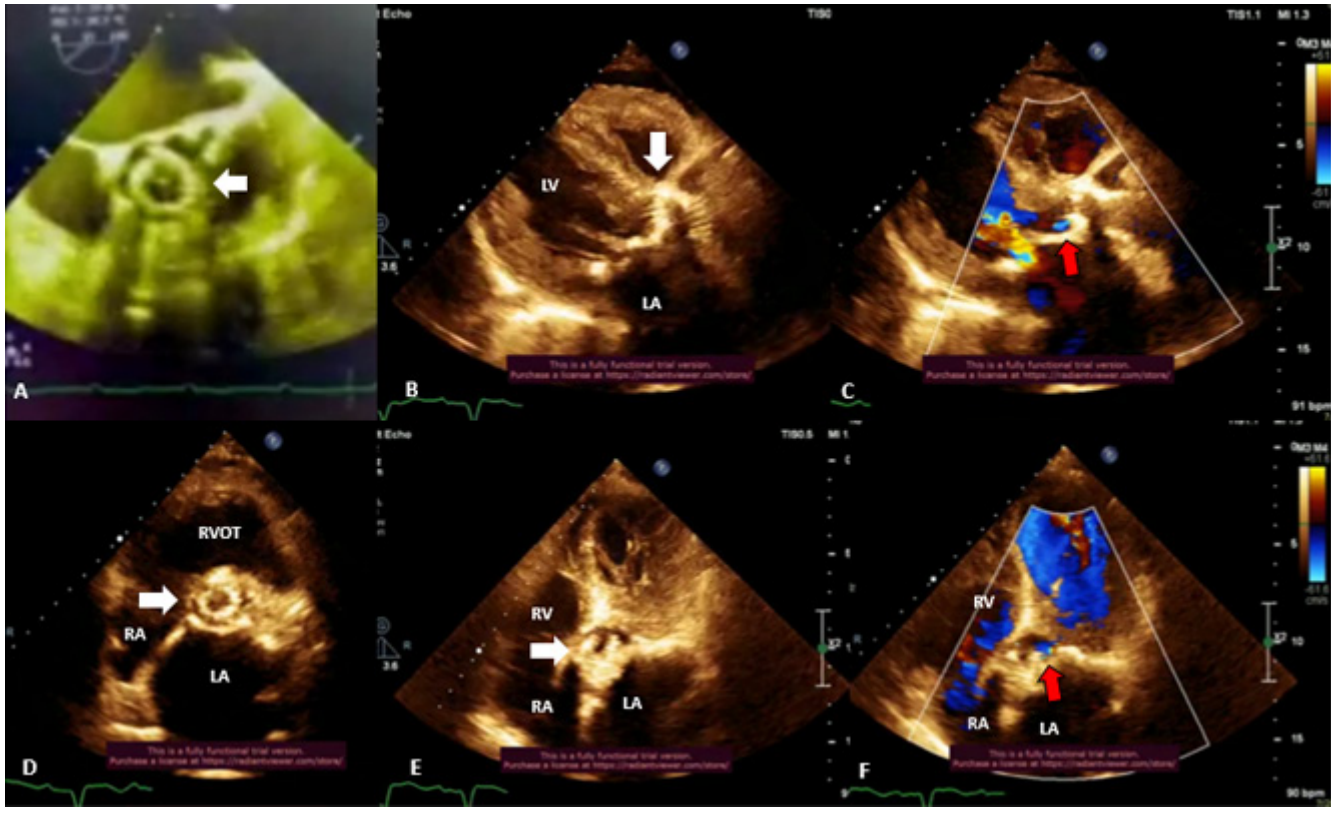

Figure 4. A) Intraprocedural transesophageal echocardiography following valve implantation reveals the valve in the correct position (the white arrow). B-F) Follow-up transthoracic echocardiography demonstrates proper valve positioning and function (the white arrow) with mild paravalvular regurgitation (the red arrow).
LV, Left ventricle; LA, Left atrium; RA, Right atrium; RVOT, Right ventricular outflow tract; RV, Right ventricle

after a few days, remarkably, with a creatinine level of 1.9 mg/dL. During 3 serial follow-up visits conducted every month postprocedurally, the patient demonstrated improved activity levels and was relatively symptom-free. TTE assessments during these visits showed normal functioning of the newly implanted bioprosthetic valve (Figure 4). (Also see additional Video File 4, which demonstrates follow-up TTE and showcases the appropriate positioning and function of the valve with mild paravalvular regurgitation.)

Discussion

IE affects 1 to 10 individuals per 100,000 annually. The prevalence is approximately 5% in prosthetic valves, with no significant difference between mechanical and bioprosthetic valves.[3, 4] The in-hospital mortality for patients admitted with left-sided IE ranges from 15% to 30%, depending on the patient's baseline conditions, the causative organism, and the presence of complications.[5]

Our patient had a history of COVID-19 infection 6 months prior and a recent hospital admission. Ramos-Martínez et al[6] found a higher-than-usual incidence of hospital-acquired IE during the first 2 months of the COVID-19 pandemic, particularly in elderly patients with damaged valves, prior cardiac surgery, prolonged hospital contact, and pre-existing heart conditions or intracardiac devices. They recommend optimal catheter care, early treatment of local infections, and appropriate use of diagnostic techniques, such as TEE, for patients with suspected IE during COVID-19 peaks. Additionally, Cosyns et al[7] observed worse outcomes in patients diagnosed with IE during the pandemic, with cerebral embolism rates reaching 18.5% in 2019 compared with 56% in 2020. Furthermore, in-hospital IE mortality during the pandemic increased to 61%, in comparison with 31% in 2019.

Approximately half of the patients affected by IE require cardiac surgery to address the infection or associated complications. However, around one-third of patients indicated for surgery due to residual valvular lesions are ineligible for surgery because of the high surgical risk.[5]

TAVI is now a well-established therapeutic option for patients with severe aortic stenosis considered at prohibitive risk for open-heart AV replacement.[1] Nevertheless, when the aortic valve is damaged following IE, TAVI may be a potential treatment option. Data from an international registry study confirmed the early safety and clinical efficacy of TAVI in the bioprosthetic valve group over the native valve group.[8]

Few cases in the medical literature discuss the use of TAVI following IE, and even fewer cases explore TAVI-in-valve procedures after IE. In 2013, Albu et al[1] described the first case of healed IE in severe aortic homograft stenosis successfully treated with a self-expandable TAVI. In 2015, Nguyen et al[9] described the first case of a valve-in-valve-in-valve procedure to treat healed IE in a patient previously treated with TAVI inside a surgical bioprosthetic valve, with a successful second TAVI procedure.

Recent studies have demonstrated that current antibiotic regimens are effective in achieving a sterile valve in a high proportion of patients with IE. Although the presence of aortic IE is generally considered an absolute contraindication for TAVI, its use in patients with residual or pre-existing aortic lesions following healed IE, particularly in the absence of predictors for active local infection, such as diabetes mellitus, Staphylococcus aureus, and concomitant compromised mitral valve, may be feasible and safe when conventional surgical aortic valve replacement is contraindicated or high risk. In-hospital and 1-year follow-up outcomes for these patients are comparable to those of standard TAVI recipients.[3, 6]

Conclusion

The COVID-19 pandemic may have contributed to an increased prevalence and worsened prognosis in patients with IE. In patients with a destroyed bioprosthetic AV due to IE and residual dysfunction after healing, the valve-in-valve procedure can be a safe option when they are at high risk for surgery.

References

1. Albu C, Swaans MJ, ten Berg JM. With the back against the wall: TAVI in a patient with endocarditis. Catheter Cardiovasc Interv 2013;82:E595-597.
2. Brankovic M, Hashemi A, Ansari J, Sharma A. Transcatheter Aortic Valve Replacement for Aortic Valve Infective Endocarditis: A Systematic Review and Call for Action. Cardiol Ther 12:297-306.
3. Anantha-Narayanan M, Reddy YNV, Sundaram V, Murad MH, Erwin PJ, Baddour LM, Schaff HV, Nishimura RA. Endocarditis risk with bioprosthetic and mechanical valves: systematic review and meta-analysis. Heart 2020;106:1413-1419.
4. De Palo M, Scicchitano P, Malvindi PG, Paparella D. Endocarditis in Patients with Aortic Valve Prosthesis: Comparison between Surgical and Transcatheter Prosthesis. Antibiotics (Basel) 2021;10:50.
5. Santos-Martínez S, Alkhodair A, Nombela-Franco L, Saia F, Muñoz-García AJ, Gutiérrez E, Regueiro A, Jimenez-Diaz VA, Rivero F, Romaguera R, Gómez-Herrero J, Rodriguez-Gabella T, Sathananthan J, Gómez Salvador I, Carrasco-Moraleja M, Rodés-Cabau J, Webb J, López J, San Román JA, Amat-Santos IJ. Transcatheter Aortic Valve Replacement for Residual Lesion of the Aortic Valve Following "Healed" Infective Endocarditis. JACC Cardiovasc Interv 2020;13:1983-1996.
6. Ramos-Martínez A, Fernández-Cruz A, Domínguez F, Forteza A, Cobo M, Sánchez-Romero I, Asensio A. Hospital-acquired infective endocarditis during Covid-19 pandemic. Infect Prev Pract 2020;2:100080.
7. Cosyns B, Motoc A, Arregle F, Habib G. A Plea Not to Forget Infective Endocarditis in COVID-19 Era. JACC Cardiovasc

Imaging 2020;13:2470-2471.
8. Shouls G, Bagnall TJ, Pandya B. The "Cooing Pigeon": TAVI for Acute Aortic Regurgitation Secondary to Homograft Degeneration. JACC Case Rep 2020;2:2162-2165.
9. Nguyen C, Cheong AP, Himbert D. Valve-in-valve-in-valve: Treating endocarditis of a transcatheter heart valve. Catheter Cardiovasc Interv 2015;86:E200-204.

Supplemental Video Legends

https://jthc.tums.ac.ir/index.php/jthc/article/view/1918/1112
Video 1. Transesophageal echocardiography reveals multiple hypermobile vegetations on the aortic bioprosthesis with severe stenosis and severe regurgitation.

https://jthc.tums.ac.ir/index.php/jthc/article/view/1918/1113
Video 2. Fluoroscopic visualization of the valve-in-valve procedure.

https://jthc.tums.ac.ir/index.php/jthc/article/view/1918/1114
Video 3. Intraprocedural transesophageal echocardiography following valve implantation demonstrates the valve in the correct position.

https://jthc.tums.ac.ir/index.php/jthc/article/view/1918/1115
Video 4. Follow-up transthoracic echocardiography shows proper valve positioning and function with mild paravalvular regurgitation.