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CASE REPORT

Transcatheter Aortic Valve Replacement(TAVR) in a patient with multiple comorbidities, prioritizing minimally invasive intervention over surgical valve replacement.

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Abstract

Background: Severe aortic stenosis (AS) poses a significant clinical challenge, particularly in patients with multiple co-morbidities where conventional surgical intervention may carry prohibitively high peri-operative risks. Transcatheter Aortic Valve Replacement (TAVR) has emerged as a promising alternative for such patients, offering a minimally invasive approach with potentially favorable outcomes. This report aims to present a case illustrating the successful application of TAVR in managing severe AS in a high-risk patient with multiple co-morbidities.

Case Presentation: The patient in question is a 56-year-old female with a complex medical history, including ulcerative colitis and prolonged steroid use. During hospitalization for abdominal complaints unrelated to cardiovascular symptoms, diagnostic workup incidentally revealed severe asymptomatic aortic stenosis. The patient's clinical presentation was further complicated by the presence of multiple co-morbidities, rendering her unfit for traditional surgical aortic valve replacement (SAVR) due to the high peri-operative risk associated with her medical condition.

Management and Results: After careful consideration, it was decided that TAVR would be the preferred intervention. Post-procedure, the patient's recovery was uneventful, with no immediate complications observed.

Conclusion: This case report highlights the importance of TAVR and the expertise required to perform this procedure in treating severe aortic stenosis in high risk patients such as in our case with favorable outcomes.

Keywords

Transcatheter Aortic Valve Replacement, Surgical Aortic Valve Replacement, Severe Aortic Stenosis, High Risk Patients.

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Introduction

Aortic stenosis (AS) stands as the foremost valvular dysfunction necessitating valve replacement, with its prevalence expected to rise significantly in the coming decades. Traditionally, surgical aortic valve replacement (SAVR) has been the cornerstone of treatment for severe AS, offering durable outcomes and symptom relief. However, in real-life clinical settings, patients often present with a constellation of co-morbidities that may complicate the feasibility of surgical intervention. In such instances, exploring alternative therapeutic modalities becomes imperative to ensure optimal patient outcomes.

Transcatheter Aortic Valve Replacement (TAVR) has emerged as a groundbreaking innovation in the field of cardiovascular intervention, revolutionizing the management of severe AS, particularly in high-risk surgical candidates. Despite its remarkable efficacy, TAVR presents unique challenges, necessitating a high level of procedural expertise and meticulous patient selection to achieve optimal outcomes. The procedure involves the percutaneous delivery of a prosthetic valve via catheter-based techniques, offering a less invasive approach compared to traditional surgery.

This case report presents a clinical vignette centered around a patient with severe AS complicated by a myriad of complex co-morbidities, posing a formidable challenge in terms of therapeutic management. While SAVR retains its well-established role in the treatment armamentarium, this article seeks to contribute valuable insights into the evolving landscape of AS management by showcasing the pivotal role and impact of TAVR in challenging clinical scenarios. Moreover, it aims to elucidate the procedural intricacies, post-intervention outcomes, and recovery associated with TAVR in this context.

By delineating the nuances of this case and contextualizing it within the broader literature on AS management, this report underscores the importance of tailored therapeutic approaches and the paradigm shift brought about by TAVR in addressing the complex needs of patients with severe AS and multiple co-morbidities. Furthermore, it emphasizes the imperative of interdisciplinary collaboration and specialized expertise in navigating the complexities of cardiovascular interventions, ultimately striving toward improved patient outcomes and quality of life.

Case Presentation

The patient, a 56-year-old female, presented with a complex medical history characterized by various co-morbidities and ongoing gastrointestinal symptoms. Her medical profile included a BMI of 36.22kg/m2, indicating obesity, ulcerative colitis diagnosed 30 years ago managed with prednisolone (5mg twice daily) and mesalazine (500mg twice daily), asthma, steroid-induced diabetes managed with insulin therapy, long-standing hypertension managed with diltiazem SR (90mg) and Losartan (50mg), dyslipidemias managed with simvastatin (20mg) and ezetimibe (10mg), multilevel lumbar stenosis resulting in restricted mobility, and known allergies to metronidazole and NSAIDs.

The patient's presentation involved abdominal pain, cramps, diarrhea, and stool incontinence persisting for 4-5 months. Initial investigations, including contrast-enhanced CT abdomen and colonoscopy with colonic biopsy, yielded normal results. Despite treatment with rifaximin, cholestyramine, loperamide, and tinidazole, her gastrointestinal symptoms persisted. A consultation with infectious diseases specialists was sought due to positive cytomegalovirus (CMV) PCR results; however, active colitis was ruled out based on the absence of colonoscopic evidence. During evaluation in the infectious diseases clinic, a loud systolic murmur was incidentally detected, prompting referral to cardiology for further evaluation.

The patient denied typical symptoms of aortic stenosis such as chest pain or syncope but reported experiencing dizziness for the past 3-4 months and shortness of breath on exertion for 3 months, attributing these symptoms to weather changes and noting improvement with the use of

a revolizer. Additionally, she reported experiencing four falls in the past 9-10 months, attributed to mechanical factors related to her lumbar spine disease.

On examination, the patient's vital signs were within normal limits, with a blood pressure of 100/70 mmHg, a pulse rate of 80/min, a respiratory rate of 18/min, and afebrile status with an oxygen saturation of 98% on room air. She appeared alert, awake, and oriented. Cardiovascular examination revealed a loud systolic murmur in the aortic area, while auscultation of the chest revealed bilateral clear lung fields. Bilateral lower extremity edema was noted on examination.

Diagnostic Assessment

The ECG exhibited a normal sinus rhythm along with evidence of left bundle branch block, characterized by a QRS duration of 76 milliseconds.

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This finding suggests an aberrant conduction pattern within the heart's electrical system.

The 2D echocardiogram revealed significant findings suggestive of severe aortic stenosis (AS) with associated structural changes to the aortic valve, including valve thickening and mild aortic regurgitation. Quantitative parameters from the echocardiogram supported the diagnosis of severe AS, with an aortic valve area of 0.9 cm^2, peak gradient across the aortic valve of 96.57 mmHg, mean gradient across the aortic valve of 57.65 mmHg, and aortic valve velocity of 4.91 m/s.

Additionally, the echocardiogram provided information regarding cardiac function, with the ejection fraction measured at 65%. This parameter reflects the percentage of blood pumped out of the left ventricle with each contraction, providing insight into overall cardiac performance

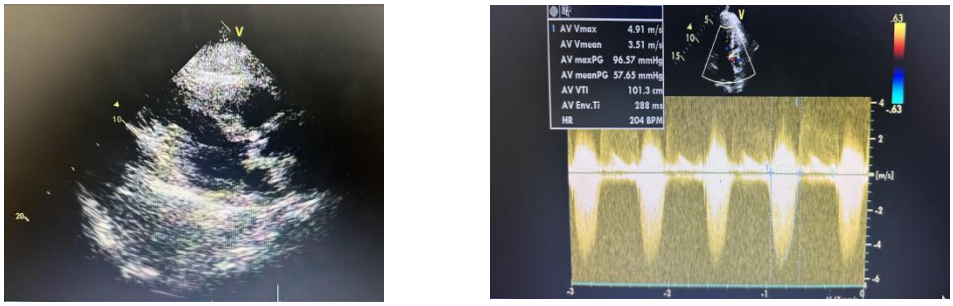

Figure 1: Echocardiogram of native aortic annulus

Therapeutic Intervention

She was started on spironolactone 50 mg and furosemide 40mg and referred to cardiothoracic surgeon who deemed her high risk for surgical

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aortic valve replacement on account of multiple co-morbidities and prolonged steroid use. She was then referred back to cardiology for TAVR. CT (TAVR protocol) was performed which showed following parameters

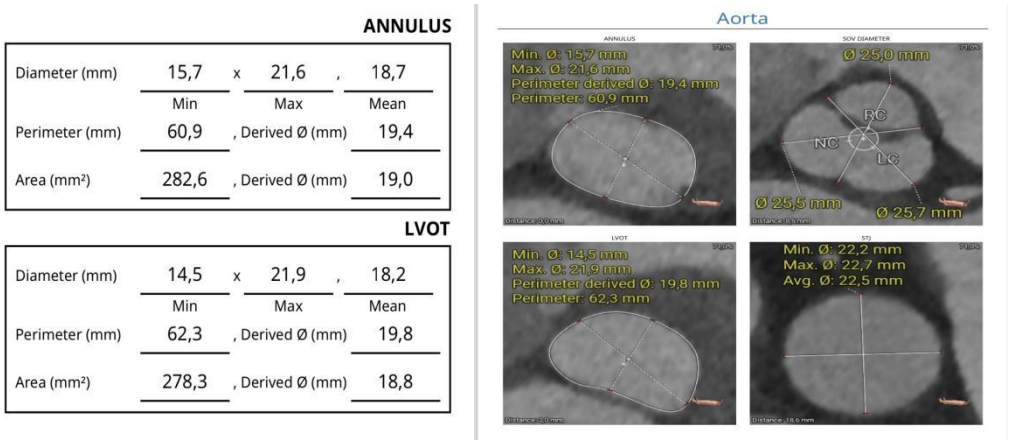

Figure 2: CT analysis of aortic valve

The procedure was performed under general anesthesia. Temporary venous pacemaker was placed via right internal jugular access for the procedure. Right common femoral access was obtained with 6Fr catheter. Major access was obtained in RCFA and secured with 2 perclose sutures. 80cc of contrast was injected and after obtaining aortography, 23mm core valve (Medtronic- EVOLUT-R) was deployed under echocardiographic and fluoroscopic guidance. Peripheral angiography of distal aortic bifurcation including bilateral iliacs was performed using DSA before large bore sheath was removed. Perclose sutures were closed and adequate hemostasis obtained at large bore access site. Final DSA of access site showed successful hemostasis

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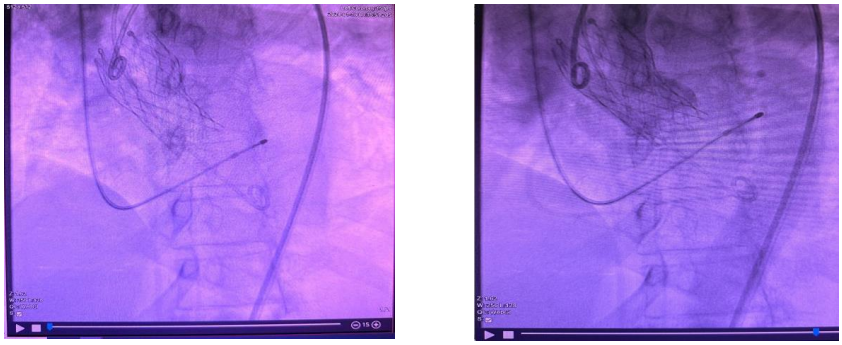

Figure 3: Angiographic images during TAVR procedure

TVP was left in-situ which was later removed on 2nd post operative day. She had right radial arterial line for invasive blood pressure monitoring. Post-operatively she was shifted to surgical intensive care unit. Initially she was on 3 litres of supplemental oxygen. Incentive spirometry was encouraged and oxygen was gradually tapered off to room air.

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Follow-up and Outcomes

Postoperative 2D echocardiography revealed a functioning aortic valve prosthesis with an aortic valve area of 2.2cm² calculated by the equation of continuity, a velocity of 2.13 m/s, a peak aortic gradient decrease to 18 mmHg, a mean aortic gradient decrease to 9 mmHg, and a DVI of 0.58

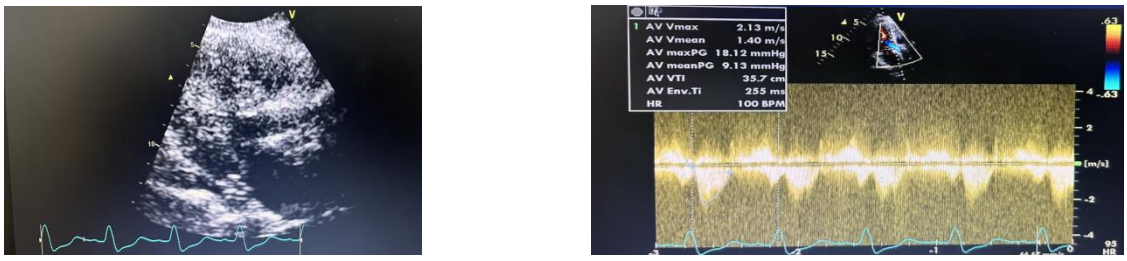

Figure 4: Echocardiographic assessment of TAVR valve showing minimal residual gradient

ECG showed broad QRS of 149ms. She remained stable and was shifted to coronary care unit. Her inflammatory markers started spiking up on 2nd post-operative day. No focus of infection was found and she remained a-febrile. Blood and urine cultures were sent. She was started on empiric antibiotics and was discharged home in stable condition on her 3rd post operative day. On her follow-up in clinic after a week, she was vitally stable, a-febrile, and her inflammatory markers were down-trending. Furthermore, ECG was performed which revealed a QRS of 78ms. She was doing well and had no active complaints.

Discussion

The normal aortic valve is one of two semilunar valves and separates the left ventricle from the aorta. It is comprised of three leaflets/cusps (left coronary, right coronary and non-coronary cusp) that are attached to an aortic annulus normally opening to approximately 3-5 cm^2. Transthoracic echocardiography is typically used to evaluate the aortic valve, however additional imaging modalities including transesophageal echocardiography and CT are also commonly used. An aortic valve is considered severely stenotic when it opens to an area of ≤1.0 cm^2. High gradient AS is the most common form of severe AS and is defined by the mean gradient of ≥40 mmHg and an aortic jet velocity of >4 m/s across the valve. Low flow, low gradient severe AS is a less common form of severe AS. This subset of patients has low flow rate across the valve either due to systolic dysfunction with reduced ejection fraction or small ventricular volumes secondary to left ventricular hypertrophy (with normal LVEF).

Etiologies of aortic stenosis include congenital (bicuspid/unicuspid), calcific, and rheumatic disease. Symptoms such as exertional dyspnea or fatigue gradually develop after a long asymptomatic latent period of about 10 to 20 years. Patients go on to develop chest pain, heart failure, and syncope. The definitive treatment for aortic stenosis includes aortic valve replacement, either via a surgical or percutaneous approach. Survival is excellent during the asymptomatic phase, but mortality is more than 90% within a few years after the onset of symptoms.

It is difficult to predict the rate of progression of aortic stenosis as it is highly variable. However, older age, severe leaflet calcification, hypertension, obesity, smoking, hyperlipidemia, renal insufficiency, metabolic syndrome, elevated circulating levels of lipoprotein A, and increased activity of lipoprotein-A are associated with rapid hemodynamic regression.

Indications for aortic valve replacement, either surgical or transcatheter, include severe high-gradient aortic stenosis with symptoms, asymptomatic patients with severe aortic stenosis and left ventricular ejection fraction less than 50%, severe aortic stenosis when undergoing other cardiac surgery, asymptomatic severe aortic stenosis and low surgical risk, symptomatic patients with low-flow/low-gradient severe aortic stenosis, and moderate aortic stenosis when undergoing other cardiac surgery.

Transcatheter aortic valve replacement (TAVR) is approved for low to prohibitive surgical risk patients with severe aortic stenosis, as well as for

valve-in-valve procedures for failed prior bioprosthetic valves.

In 2002, Dr. Alain Cribier performed the first successful percutaneous aortic valve replacement on an inoperable patient. The first approval of TAVR for the indication of severe AS in prohibitive risk patients came in 2011. In 2012, the FDA approved TAVR in patients at high surgical risk. In 2015 the indication was expanded to include "valve-in-valve" procedure for failed surgical bioprosthetic valves. In 2016 the FDA approved TAVR valves for use in patients with severe AS at intermediate risk. Following the results of the PARTNER-3 trial published in 2019, the FDA further expanded the indication for TAVR valves to include low risk patients.

In high-risk patients with severe aortic stenosis, transcatheter and surgical procedures for aortic-valve replacement were associated with similar rates of survival at 1 year, although there were important differences in periprocedural risks.

Multiple trials including PARTNER-3, SURTAVI and NOTION were carried out to assess the superiority of one procedure over the other (SAVR vs TAVR) however, the ultimate decision depends on the Heart Valve team taking into consideration the life expectancy, frailty, and co-morbidities of the patient.

Calculating the risk of TAVR can be complicated. In patients who are electively treated using transfemoral access and a less invasive approach, the short-term risk of mortality is very low. Risk calculators can be used to estimate short-term risk, but the patients who are high risk for in-hospital mortality are often fairly easy to recognize, as the factors that drive that risk are not subtle (eg, patient is in shock at the time of the procedure). The true risk of TAVR lies in the inability to recover from the procedure—being chronically ill, frail, or debilitated to a degree that the patient either dies or fails to recover a reasonable quality of life. Given the overlap of symptomatic aortic stenosis with true frailty, it is often difficult to identify these patients who will not thrive after TAVR. Understanding the patient factors that most strongly drive risk of poor outcomes after TAVR is important.

Conclusion

Aortic stenosis in the setting of multiple complexities, as in our case with diabetes, hypertension , chronic GI pathology, high BMI and chronic steroid use(increased propensity of bleeding and infections) poses a great challenge to its management. As we see the evolution of TAVR and its impact on cardiovascular intervention in patients with multiple complexities, the timely decision by interventional cardiologists and cardiothoracic surgeons with adequate planning can significantly improve patient outcomes and is a viable option for patients with high surgical risk. The favourable patient outcome in this case coupled with the minimally invasive nature of TAVR emphasizes its growing prominence in management of aortic stenosis.

Nevertheless, the procedure requires high level of expertise along with precision and proficiency in navigating complex anatomies and managing potential complications. To conclude, judicious use of minimally invasive procedure i.e TAVR can significantly reduce morbidity and mortality and improve outcomes at short and long term.

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