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Transcatheter Aortic Valve Implantation in Post Coronary Artery Bypass Graft Patient

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ABSTRACT

Patients with a prior coronary artery bypass graft and severe aortic stenosis represent a unique subset. Surgical aortic valve replacement is a strong contraindication in patients with severe aortic stenosis who have a history of coronary artery bypass grafting. In this case report, we share our experience with transcatheter aortic valve implantation in a post-coronary artery bypass graft patient at Shahid Gangalal National Heart Center, an emerging transcatheter aortic valve implantation center in Nepal.

Keywords: Aortic stesosis; Coronary Artery Bypass Graft; transcatheter aortic valve implantation.

INTRODUCTION

The minimally invasive nature of transcatheter aortic valve implantation (TAVI) has made this procedure an attractive option for patients with symptomatic aortic stenosis (AS) with elevated surgical risk. Many factors increase the risk associated with surgical aortic valve replacement (SAVR) including porcelain aorta, prior sternotomy, prior chest irradiation, severe chest deformity, medical frailty, significant lung disease, and cirrhosis.[1]Previous studies have shown that cardiac reoperation is associated with an increase in perioperative myocardial infarctions, low output heart failure, and death.[2] Because AS is mainly a disease of the elderly, a significant proportion of these patients have undergone previous coronary artery bypass grafting (CABG) surgery.[3] Patients with a previous CABG and severe AS represent a unique set of patients.[4] The strongest contraindication to SAVR is a history of CABG.[1] CABG is particularly high-risk secondary to iatrogenic changes in anatomy, such as a left internal mammary artery that crosses the midline.[1] It is hypothesized that patients with a previous CABG are prone to specific TAVI-related complications owing to the commonly existing significant atherosclerotic disease, cardiomyopathy, and conduction system disease.[5] There is conflicting evidence in the post-CABG population regarding TAVI outcomes. Greason et al. found that compared to SAVR, TAVI was associated with a non-statistical trend toward greater all-cause mortality and a significant increase in rehospitalization. In the study, TAVI was associated with a 36.1% death rate at 2 years. On the other hand, studies by Nguyen et al. and others have shown similar to improved outcomes with TAVI in this specific population. In a single-center study of patients undergoing TAVI, no difference in overall survival was observed between patients with a prior history of CABG and a cohort of patients without a history of CABG. A history of prior CABG was associated with an increased risk of post-TAVR PPM implantation. This study affirms the efficacy and safety of TAVR in prior CABG patients compared to other TAVI patients at lower predicted surgical risk. In this case report, we share our experience of TAVI in post CABG patient in Shahid Gangalal National Heart center, an emerging TAVI centre of Nepal.

CASE REPORT

An 84-year-old male was referred for TAVI with the diagnosis of severe degenerative aortic stenosis. He had dyspnea on exertion (NYHA functional class III), Chest pain and syncope. He underwent CABG with LIMA to LAD and SVG to OM grafts 16 years

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ago. He is hypertensive and diabetic. ECG showed Sinus Rhythm with LV hypertrophy. Echocardiogram revealed degenerative tricuspid aortic valve with severe aortic stenosis. There was concentric left ventricular hypertrophy. The calculated aortic valve area was 0.8 cm2, the peak velocity was 4.1 m/s, the peak gradient across the aortic valve was 67 mmHg, and the mean pressure gradient was 47 mmHg, as shown in Figure 1.

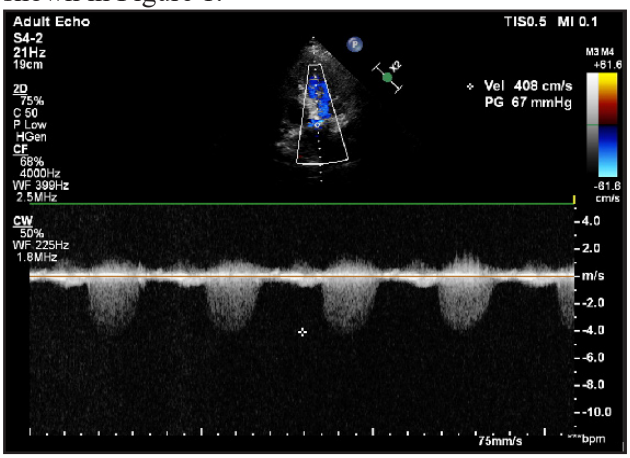

Figure 1. Echocardiogram. Pressure gradient across the aortic valve before TAVI.

The aortic annulus diameter was 20.2 mm and the left ventricular ejection fraction was 65%. Coronary Angiogram revealed patent LIMA to LAD graft, Occluded OM1 graft, non-dominant RCA with 70% lesion in distal RCA.

CT revealed a Mean Annulus Diameter of 23.8 mm, Annulus Perimeter of 74.3 mm, Sinus of Valsalva Mean Diameter of 32.6 mm, and Mean Sinus of Valsalva height of 21.5 mm. Annulus Area is 423.6 mm^2. The height of the right coronary ostia was 17.1 mm, while the height of the left coronary ostia was 14.6 mm. The average diameters for the right common iliac, external iliac, and femoral arteries were 5.9 mm, 4.9 mm, and 8.5 mm, respectively. The average diameters for the left common iliac, external iliac, and femoral arteries were 7.0 mm, 9.1 mm, and 8.1 mm, respectively. Based on the CT analysis, the 29 mm Core Valve Evolut PRO+ (Medtronic) was deemed suitable.

Informed consent was obtained from the patient and his family. TAVI was performed in the cardiac catheterization lab. All the prerequisites of procedures were pre-checked by an anesthesiologist, cardiologists and cardiac surgeons. An operation theatre was kept prepared in case of an emergency. The procedure was done under conscious sedation. Transthoracic echocardiography (TTE) was performed to provide imaging during the procedure. The right radial artery, left radial artery, right femoral vein, and left femoral artery were cannulated. Continuous arterial pressure monitoring was done through the left radial artery. Right femoral vein access was used to place a temporary pacemaker in the right ventricle. The right radial artery was used to introduce a 6-Fr graduated pigtail catheter through a 6-Fr sheath into the noncoronary sinus as a marker for valve placement and to allow arteriography during the TAVI valve placement for positioning. The left Femoral artery was used to deliver the TAVI valve. Once all arterial and venous accesses were achieved, intravenous unfractionated heparin was administered to achieve a recommended activated clotting time of >250 s.

A soft, J-tipped 0.035-mm wire was placed into the descending thoracic aorta (DTA) through the left femoral artery, Preclosure with two suture-mediated closure devices (Perclose ProGlide®, Abbott Laboratories, Abbott Park, IL) were deployed at 2- and 10- o'clock positions, with maintenance of arterial access with the J-tipped guidewire. A 6-Fr AL-1

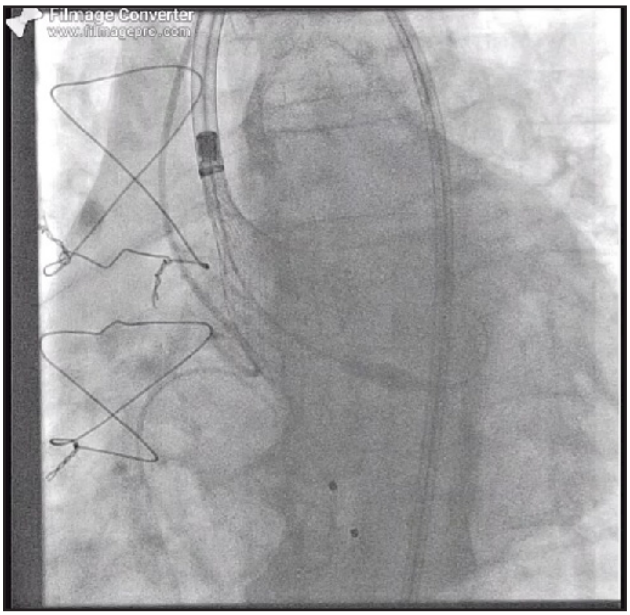

Figure 2. Echocardiogram. Pressure gradient across the aortic valve before TAVI.

catheter is passed through the valve delivery sheath over a 145-150 cm 0.035-inch J-tipped guidewire and exchanged for a straight-tip wire to cross the valve. Once across, the straight-tip wire is exchanged for a 300-cm J-tipped wire. The AL-1 catheter is then removed and exchanged for a 6-Fr angled pigtail catheter. A preshaped stiff guidewire (Confida™ Brecker, Medtronic, Inc., Minneapolis, MN) is then placed through the angled pigtail catheter into the left ventricle, with the transition point of the guidewire held above the apex, and pointing away from the ventricular wall. A16-F equivalent catheter EnVeo DCS InLine Sheath (Medtronic) mounted with the Evolut Pro+ valve, was then advanced "sheathless" into the patient and implanted at the annulus as shown in Figure 2.

Core valve Evolut PRO+ (Medtronic USA) was deployed under pacing of 180 beats/min. The position of the valve was checked with a root aortogram using a pig-tail catheter before and after deployment. We positioned 4mm below the native annulus. The root aortogram and coronary angiography revealed the optimal position of the bioprosthesis and normal coronary perfusion as shown in Figure 3.

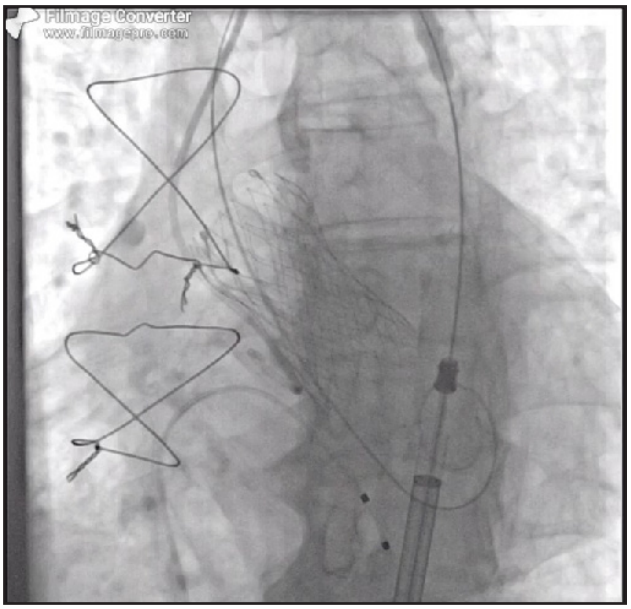

Figure 3. Fluoroscopic image shows deployment of the Evolut Pro+ valve.

The immediate post-deployment transthoracic echocardiography showed a good position, normal leaflet motion, no paravalvular leakage and a mean pressure gradient of 3 mmHg as shown in Figure 4.

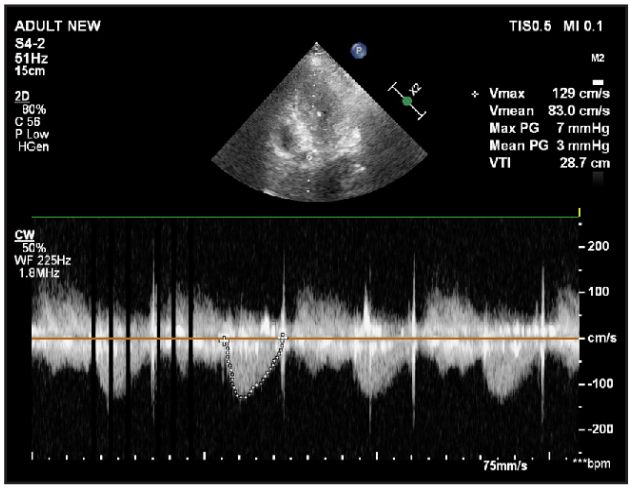

Figure 4. Trans aortic gradient after TAVI.

post-TAVI valve implantation ECG showed complete heart block. Following successful valve implantation, EnVeo DCS was removed, and while maintaining wire position, the ProGlide® was deployed. After the procedure patient was shifted to the cardiac intensive care unit. The ccomplete heart block reverted to normal sinus rhythm after two hours. He was observed for 48 hours with a temporary pacemaker. During the 48-hour observation patient never developed complete heart block. His ECG showed a normal sinus rhythm. He was discharged on postoperative day 4. The postoperative echocardiography before discharge showed good prosthetic valve function with a mean aortic gradient of 4 mmHg with trace paravalvular leak and good left ventricular ejection fraction.

DISCUSSION

The advent of TAVI has transformed the management of severe symptomatic aortic stenosis (AS), particularly in patients deemed high-risk for surgical aortic valve replacement (SAVR). Our case highlights the successful application of TAVI in an 84-year-old male with a prior history of CABG, representing a subset of patients traditionally considered high-risk surgical candidates. Patients with previous CABG pose distinct challenges during SAVR, including the risk of re-sternotomy, damage to patent grafts, particularly a left internal mammary artery graft crossing the midline, and perioperative complications such as low output syndrome, myocardial infarction,

and increased mortality rates.[2] The presence of comorbidities such as diabetes mellitus, hypertension, and left ventricular hypertrophy, as seen in our patient, further compounds procedural risks. In this context, TAVI emerges as a minimally invasive and safer alternative.

Despite its theoretical advantages, outcomes of TAVI in the post-CABG population have been debated. Greason et al. reported a non-significant trend toward increased all-cause mortality and higher rehospitalization rates in TAVI compared to SAVR in this cohort, with a 2-year mortality rate of 36.1%.[6] Nguyen et al. and others have shown comparable or even improved outcomes in patients undergoing TAVI post-CABG.[6] A notable finding across these studies is the increased incidence of post-procedural permanent pacemaker implantation in the prior CABG group, likely attributable to underlying conduction system disease or procedural trauma.[5] In our case, TAVI was preferred due to the patient's advanced age, prior sternotomy with LIMA graft, and overall frailty. Preprocedural computed tomography angiography (CTA) enabled precise sizing and evaluation of access vessels, aiding in the decision to use a 29 mm Evolut PRO+ valve. Though the right and the left femoral routes were calcified, the left femoral approach was selected as the left femoral route was wider than the right femoral. TAVI was performed under conscious sedation, minimizing anesthesia-related complications. Intra-procedurally, the valve was deployed under rapid pacing, and accurate positioning was confirmed with fluoroscopy and aortography. Post-deployment echocardiography showed a well-seated prosthesis without paravalvular leak and a single-digit transvalvular gradient. Though the patient developed complete heart block after the procedure but it reverted to sinus after two hours of the procedure.

This case underscores the importance of individualized decision-making and multidisciplinary assessment in TAVI. It also reflects the feasibility and safety of TAVI in patients with prior CABG, reinforcing findings from emerging centers and global registries. As TAVI becomes increasingly accessible, particularly in developing cardiac centers such as Shahid Gangalal National Heart Center, Nepal, accumulating institutional experience and outcomes data will be crucial to refining patient selection and optimizing procedural success in complex populations.

CONCLUSION

TAVI in post-CABG patients is the preferred option. Complete equipment, a team approach, and preparation for unwanted fatal complications were required to achieve a successful result.

Conflict of interest: None

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