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Geriatric patient for transcatheter pulmonary valve replacement for restenosis of implanted pulmonary valve

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Abstract
Transcatheter Pulmonary Valve Replacement (TPVR) is a safe, less invasive alternative to surgical valve replacement for patients with right ventricular outflow tract stenosis. TPVR is relatively newer procedure has mostly been described in mostly young and middle aged individuals. We describe a case report of a 76 years old female patient who presented with restenosis of replaced Pulmonary valve. Patient was case of congenital Pulmonary stenosis and Ventricular septal defect underwent Open surgery and Transcatheter Pulmonary Valvoplasty in past.
There are very few reports of geriatric patients undergoing the procedure. There is difference of opinion regarding choice of anaesthesia – Deep Sedation vs General Anaesthesia, choice depending upon patient condition and setup available.
Understanding of possible complications and effective communication with the cardiology team are the keys for safe intra-operative management.

Keywords: Transcatheter, pulmonary, valve, replacement, TVPR, implantation

Introduction
TPVR is a safer, less invasive alternative to surgical valve replacement. There is limited data comparing TPVR with surgical techniques but it suggests short-to-medium term outcomes for TPVR are very promising with low morbidity and low valve failure rates [1]. TPVR procedure has been described in mostly young and middle aged individuals [2, 3]. There are very few reports of geriatric patients undergoing the procedure [4]. Our patient was oldest patient in India to undergo this procedure. There is difference of opinion regarding choice of anaesthesia – Deep Sedation vs General Anaesthesia, choice depending upon patient condition and setup available.

Case Report
A 76 years old, 47 kgs, female patient presented with history of giddiness since 1 month and dyspnea on exertion, NYHA grade 3-4. Patient was a case of congenital Pulmonary stenosis and Ventricular septal defect first diagnosed in 1972 (at age of 28 years) in view of breathlessness. In 1974, Open pulmonary Valvulotomy was done after which patient was free symptomatically. Then again in 2012 presented with breathlessness and was found to have pulmonary stenosis and Open Pulmonary Valve replacement was done with Ventricular septal defect closure was done simultaneously. Further in 2015, she developed breathlessness again and was found to have Prosthetic valve stenosis and Ballon Valvulotomy was done. Following this patient was better and able to do all her routine activities.
She was also a case of Seasonal bronchial Asthma, not on any active medication for the same.

Her regular medications consisted of Tab. Torsemide 10mg once a day
Cardiac CT showed severe pulmonary valvular restenosis (9mm x 18mm) with post stenotic marked dilatation of the distal Middle PA (45mm), branch pulmonary arteries. There is also Supravlavular stenosis at distal ring of the prosthetic valve, where it measures 22mm x 15mm. Diffuse calcification of the prosthetic valve ring was noted on left side. Mild disease of the proximal LAD, RCA noted. Markedly dilated RA, RV.

Echocardiography showed Severe tricuspid regurgitation. Estimated RV systolic pressure of 85 mm Hg. Dilated right atrium and ventricle with volume overload. Mildly depressed RV systolic function (TAPSE: 11 mm). Bioprosthetic pulmonary valve dysfunction. Peak systolic gradient across pulmonary valve is 60 mmHg. Mild Pulmonary regurgitation (mostly intraprosthetic). Normal left ventricular cavity with good contractility. Overall Left ventricular EF was 60%. Normal LA dimensions.

Biochemical and Haematological testing was within normal limits

Monitoring used intraoperatively consisted of ECG, ETCO2, NIBP, IBP, SO2, CVP, Temperature, Urine Output. Defibrillator, TEE and Transthoracic Echocardiography were kept.

Intravenous access was secured with 20G line on left hand. On Right hand, radial artery was cannulated with 20G line, for continuous invasive BP monitoring. General anaesthesia was induced with IV Fentanyl 2 mcg/kg, IV Etomidate 0.15mg/kg titrated to effect. After confirming mask ventilation, IV Atracurium 0.5mg/kg was given and intubated with No 7 cuffed endotracheal tube. Maintained with Oxygen / Air with FiO2 of 0.5 and Desflurane adjusted to MAC of 0.7-0.8. Right Internal jugular vein was cannulated with 7Fr triple lumen catheter. A temporary pacing wire was placed by interventional cardiologist.

Intraoperative IV Adrenaline and IV NorAdrenaline infusion was started to maintain BP intraoperatively. Maximum dose of IV Adrenaline 0.01 mcg/kg/min and IV NorAdrenaline 0.01 mcg/kg/min, stopped before extubation. Intermittent IV Atracurium boluses were given. IV Heparin given to maintain Activated Clotting time more than 250 seconds. Intraoperatively 800ml of IV fluid was infused and Urine output was 300ml.

Interventional cardiologist placed guidewires in both LAD and RCA, as a precautionary measure in event of aortic sinus getting compressed after prestenting of old valve or after final valve placement, and need for emergency coronary artery angioplasty. Temporary Rapid Ventricular Pacing (RVP) is used during prestenting of old valve or final valve deployment. During this time there was transient fall in BP was managed by use of IV Phenylepherine boluses of 50-100mcg.

During periods of balloon dilatation of valve also, there is brief fall in Blood pressure due to decreased output reaching left side. This was also managed by use of IV Phenylepherine boluses of 50-100mcg. There is spontaneous recovery of blood pressure following deflation of balloon.

Total of two arterial sheaths and two venous sheaths is used during procedure.

Arterial sheath for placing guidewires in both LAD and RCA and venous sheaths for pacing wire and deployment of stent. Medtronic Melody pulmonary valve was placed using 22 Fr Delivery sheath with dimensions of diameter of valve 18mm and Stent length was 34mm.

Patient was reversed with IV Neostigmine 0.05mg/kg and IV Glycopyrollate 0.01mg/kg.

Heparin was reversed with protamine. Procedure lasted 180 minutes. She remained haemodynamically stable throughout the procedure. There were no perioperative complications noted. Coronary arteries showed not compression. Transthoracic Echocardiography done showed mild Pulmonary Regurgitation and no paravalvular leak.

Patient was shifted to ICU for observation

Echocardiography done 2 days later showed normally functioning prosthetic pulmonary valve with peak/mean gradient 13/6 mmHg. No evidence of paravalvular leak. Trivial Pulmonary regurgitation. Dilated RA and RV. Mildly depressed RV systolic function (TAPSE: 15 mm). Mild pulmonary hypertension. Moderate tricuspid regurgitation. RVSP: 45mmHg. Intact IVS. No residual shunt seen across it. Normal left ventricular cavity with good contractility. Overall LV EF: 60%. Normal LA dimensions.

Later she had uneventful course in hospital prior to discharge

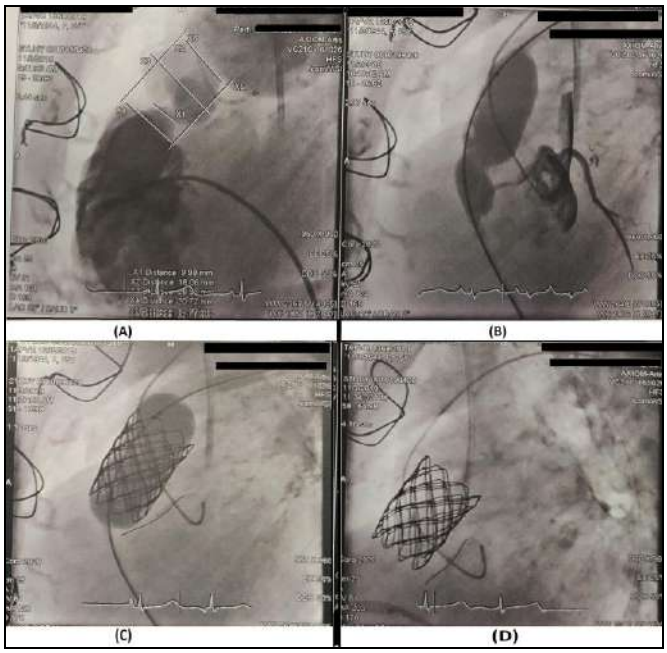

Fig 1: Flouroscopy pictures showing (A) Pulmonary stenosis (B) Coronary catheterisation and dilatation of old valve (C) Stent placement and dilatation (D) Final stent in place

Discussion

TPVR procedure has been described in mostly young and middle aged individuals. [2,3] Our patient is the probably the oldest recorded undergoing the procedure.

Understanding underlying pathology, the severity of myocardial dysfunction, preexisting arrhythmias and cardiac devices and other organ system dysfunction that potentially could complicate perioperative management is essential [5].

There is difference of opinion regarding choice of anaesthesia – Deep Sedation vs General Anaesthesia, choice depending upon patient condition and setup available.

For TPVR patient immobilisation is crucial hence most cases are done under General Anaesthesia.

Although there is limited literature regarding cases comparing GA vs Sedation for TPVR. Since it is similar procedure to transcatheter aortic valve replacement, sedation may be good option in certain indivdiuals. It allows for a shorter procedure time, shorter intensive care unit stay, and less vasoactive support and similar outcome in both groups [6, 7]. The main disadvantage of sedation is emergency need for conversion into GA which can have significant hemodynamic instability.

For TPVR cases done under sedation it is important to note that, TPVR is not very painful with exception of phases during procedure such as arterial cannulation, central venous access, valve dilation and implantation. Some authors suggest strategy of using Propofol and Remifentanil TCI with targeted BIS between 60 and 80. Capnography is recommended as it early detection of hypoventilation, thus improving the titration of TCI rate or performing of manoeuvres to open airways. Sedation is beneficial as it allows early neurological monitoring [8].

In our case, we opted for General Anaesthesia as patient had undergone multiple procedure and possible procedural difficulties. Also patient had borderline difficult airway hence we felt it would be appropriate to secure it prior to procedure.

Anaesthetic management for a patient undergoing TPVR has not been described in anesthesia literature. Similarity in transcatheter aortic valve replacement allows us to consider about acute complications and anaesthetic management of TPVR plan based on a similarity of principles [5].

Apart from standard ASA monitors, radial arterial BP monitoring is recommended in all patients undergoing TVPR especially high-risk patients. Controlled induction with Vasopressor support to maintain hemodynamic stability. Possibility of open emergency or surgical intervention warrants need for large-bore intravenous access typically is obtained. Blood and blood products to be kept ready. Central venous access is required, if a need for postoperative inotropic support is anticipated. Pulmonary artery catheterization is not performed routinely.

The procedure is performed in cardiac catheterization room or hybrid operation room equipped with fluoroscopy. The interventional cardiologist, places arterial sheath to allow left heart catheterization to look for coronary artery compression after balloon inflation for dilatation of pulmonary stenosis. A temporary pacemaker is also placed in the event of heart block and induce Rapid Ventricular pacing. Target activated clotting time is more than 250 seconds.

Right-heart catheterization is performed. Balloon dilations of pulmonary stenosis is performed with simultaneous coronary angiography to look for coronary artery compression or aortic root compression taking place.

During periods of balloon dilatation there is brief fall in Blood pressure due to decreased output reaching left side with spontaneous recovery following deflation of balloon. At such time, anaesthesiologist should be watchful to look for arrhythmias, heart block and ECG changes that may appear. Also there may be need for bolus of vasopressors or vasoactive infusions during the procedure.

After balloon dilation, pre-stenting commonly is performed. Multiple stents might be needed to prevent stent fractures and adequately prepare the conduit. Rapid ventricular pacing is induced to reduce cardiac output sometimes is used to avoid potential valve migration.

Acute hemodynamic changes occur during dilatation and valve deployment. There is also risk of RVOT rupture, pericardial tamponade, valve embolization, or tricuspid valve injury. Angiography and echocardiography should be performed to identify the source of hemodynamic compromise and treat accordingly.

At the completion of the procedure, heparin is reversed with protamine.

In perioperative period for TPVR assessment of the pulmonary valve, Echocardiography is performed via Transthoracic or TEE or intracardiac echocardiography (ICE). TEE is used to accurately acquire the information necessary to confirm pulmonary valve pathology and evaluate for complications during and after valve implantation [9]. In patients with symptoms of endocarditis, ICE has emerged as a potential alternative to TEE for evaluation and diagnosis of prosthetic valve or device-related infection [10].

In our case, we had kept TEE but post procedure Transthoracic Echocardiography showed mild Pulmonary Regurgitation and no paravalvular leak. Hence decided not to go ahead with TEE. As there was no extra information to be gained which would change the post-operative management.

Conclusion

TVPR has been an excellent alternative to open surgery in geriatric patients considering multiple co-morbidities, shorter ICU and hospital stay. Improvements in procedure and understanding has helped to carry out the procedure safely. For anaesthesiologist it is essential to know various complications that could arise and ways to deal with it. TPVR requires suitable anaesthesia, along with good team work, leading to relief of symptoms and early recovery.

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