

# State-of-the-Art Periprocedural 3D Transesophageal Echocardiography during Transcatheter Mitral Valve-in-Valve Implantation


Jason N. Dungu, PhD, BSc, MBBS, MRCP\*, Nilesh Sutaria, MBChB, FRCP, MD, Ben Ariff, MRCP, FRCR, PhD, Angela Frame, Jonathan Cousins, FRCA, MBBS, BSc, John R. Anderson, MBChB, FRCS, Andrew Chukwuemeka, MBBS, MD, FRCS, Ghada Mikhail, BSc, MBBS, MD, MRCP, Iqbal S. Malik, MBBCh, MA, FRCP, PhD

Cardiovascular Department, Imperial College Healthcare NHS Trust, Hammersmith Hospital, London, UK

## Abstract

An 88 year old lady, with a previous 25 mm Carpentier-Edwards 6900 Perimount pericardial mitral bioprosthesis in 2007 for severe mitral regurgitation, presented in September 2013 with shortness of breath on mild exertion with New York Heart Association class 3 heart failure. Transthoracic and transoesophageal echocardiography demonstrated good biventricular systolic function but significant transvalvular mitral prosthesis regurgitation and severe restriction of the leaflets. She was reviewed by the cardiothoracic surgeons and turned down for re-do mitral valve surgery due to frailty. The mitral multi-disciplinary team recommended transcatheter mitral valve-in-valve implantation.

A temporary pacing wire was inserted via the right internal jugular vein. The procedure was performed via transapical access with a 6F sheath. A standard J-wire crossed the mitral valve easily with the aid of a pigtail catheter. The Transcatheter Aortic-Valve Implantation delivery sheath was positioned across the mitral valve prosthesis, guided by 2D and real time 3D transoesophageal echo (TOE) and fluoroscopy. A 26 mm Edwards XT Ascendra Transcatheter Valve (Edwards Lifesciences, Irvine, California) was deployed successfully under rapid pacing within the bioprosthetic ring. A good position was seen on fluoroscopy and 2D and 3D TOE showed only minimal paravalvular leak. A significant increase in


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Cardiovascular department, Imperial College Healthcare NHS Trust, Hammersmith Hospital, Du Cane Road, London, UK.



Disclosures: None

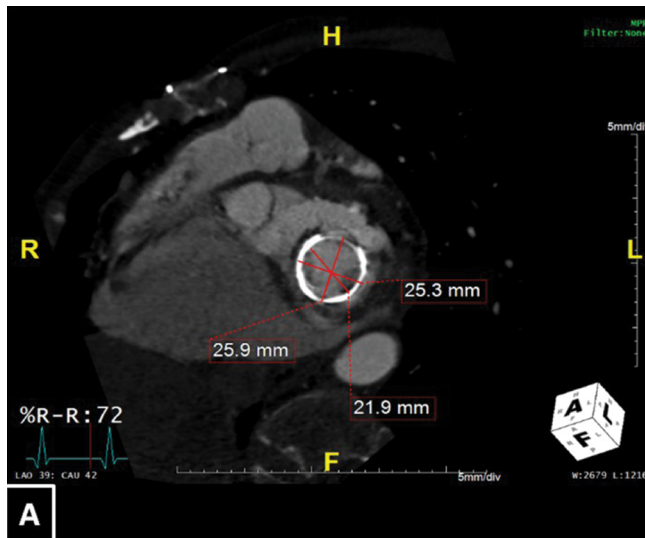
**Slideshow.** Click on the presentation above to view the presentation online. You may download the file at <http://dx.doi.org/10.12945/j.jshd.2016.002.14.ppt.01> (5.6MB).

**mitral valve area and reduction in transmitral gradient was observed. The patient was discharged on day 6 and remains well at 6 months review.**

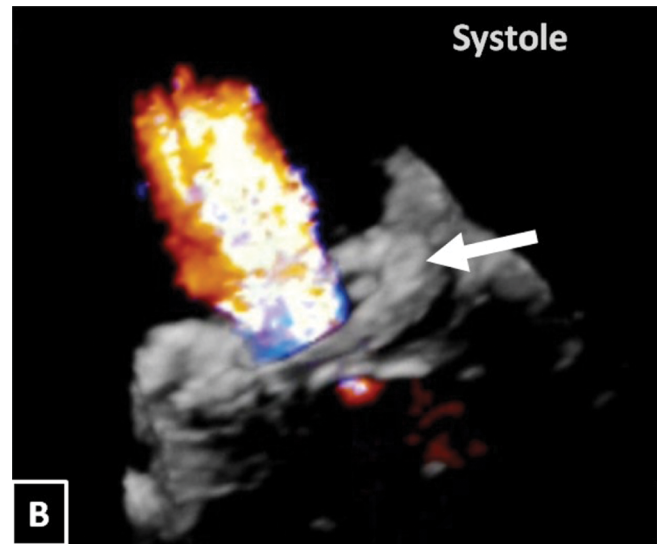
**Valve-in-valve implantation, a new technology only possible with state-of-the-art imaging, is a viable treatment option for degenerative tissue bioprosthesis disease in high risk surgical patients.**

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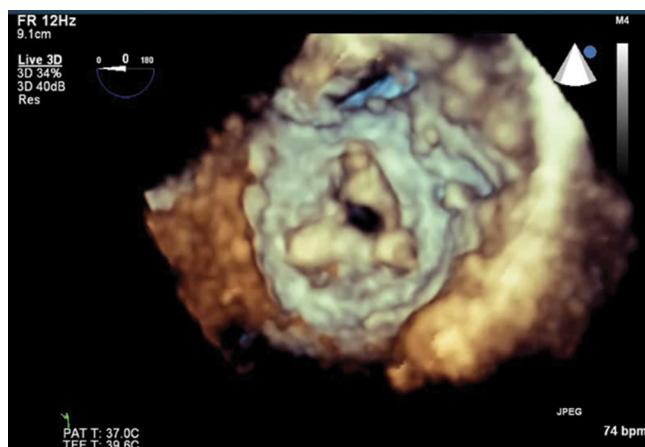




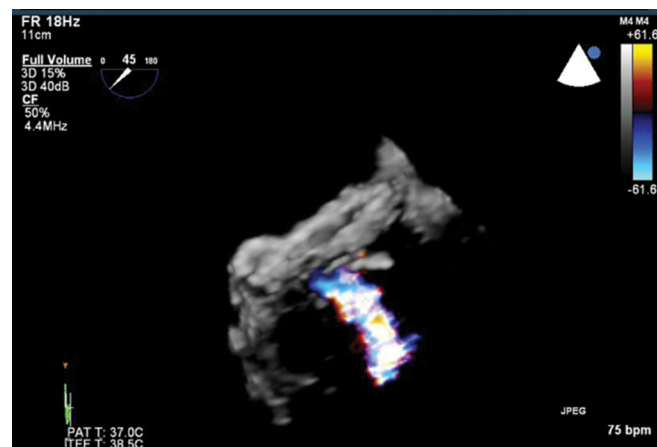
**Figure 1.** Sizing of the prosthetic annulus preprocedure by computed tomography, confirming maximum diameter of 25.9 mm.



**Figure 2.** A 3D transoesophageal echo full volume colour in systole, demonstrating severe transvalvular mitral regurgitation.



**Video 1.** Real-time 3D zoom (left ventricular view) pre-intervention, demonstrating severely restricted bioprosthetic leaflet opening. View supplementary video at <http://dx.doi.org/10.12945/j.jshd.2016.002.14.vid.01>.



**Video 2.** Full volume 3D color Doppler pre-intervention, demonstrating severe transvalvular regurgitation and turbulent diastolic flow due to severe mitral bioprosthesis stenosis. View supplementary video at <http://dx.doi.org/10.12945/j.jshd.2016.002.14.vid.02>.

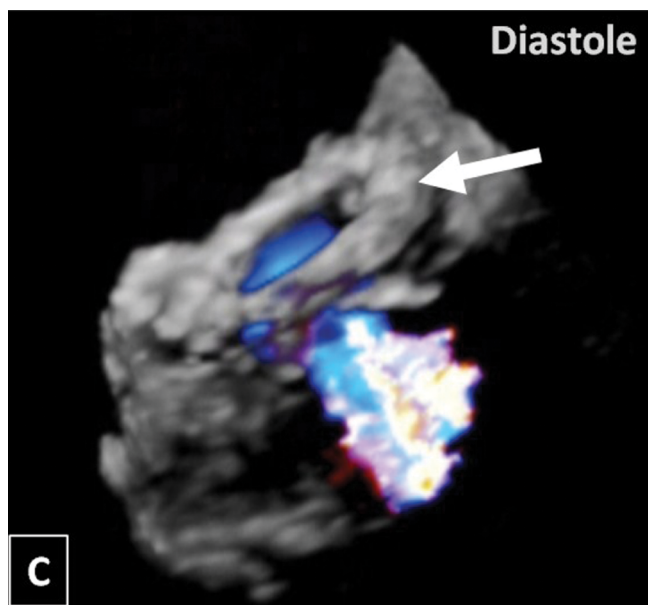
## Key Words

**Valve-in-valve • Mitral bioprosthesis • TAVI • Percutaneous intervention • 3D transoesophageal echocardiography • General**

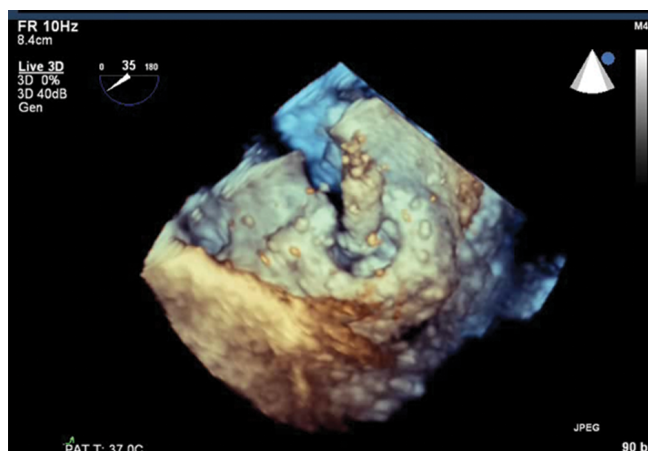
Transapical transcatheter mitral valve-in-valve implantation was first reported in 2009 [1] and small case series have been reported [2, 3]. We present a case of transcatheter aortic valve implantation (TAVI) in the

mitral position, highlighting the role of 3-dimensional echocardiography during this complex intervention in the cardiac catheter laboratory.

An 88-year-old lady, with a previous 25-mm Carpentier-Edwards 6900 Perimount pericardial mitral bioprosthesis in 2007 for severe mitral regurgitation, presented in September 2013 with shortness of breath on moderate exertion with New York Heart Association (NYHA) class 3 heart failure. Transthoracic

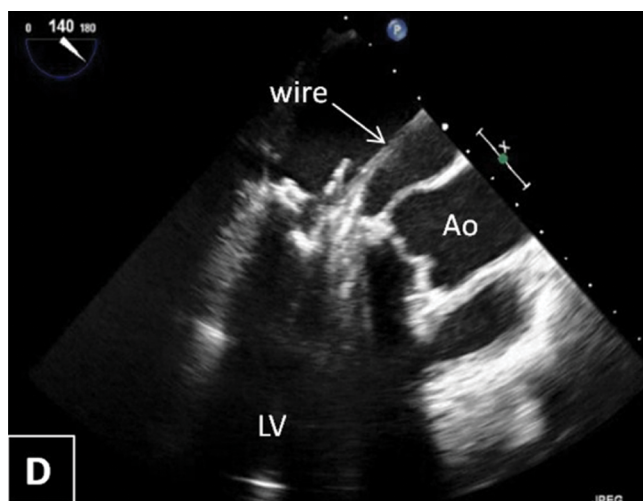


**Figure 3.** A 3D transoesophageal echo full volume colour in diastole, demonstrating flow convergence and turbulence secondary to mitral prosthesis stenosis. Solid arrow: Mitral valve prosthesis.

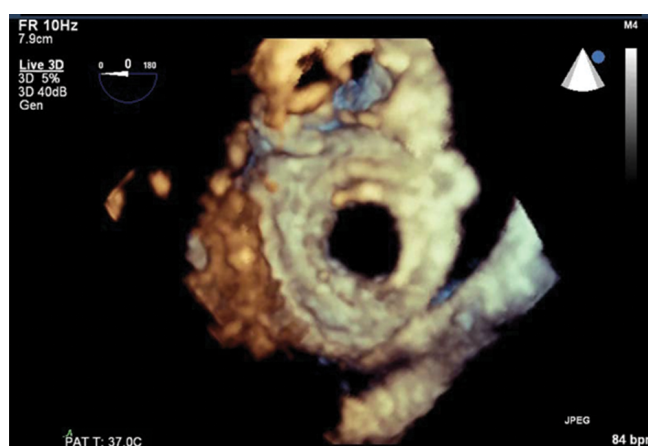


**Video 3.** Live 3D transoesophageal echo-guided positioning of transcatheter aortic valve implantation in the mitral position. View supplementary video at <http://dx.doi.org/10.12945/j.jshd.2016.002.14.vid.03>.

and transoesophageal echocardiography demonstrated good biventricular systolic function but significant transvalvular mitral prosthesis regurgitation and severe restriction of the leaflets. Left and right heart catheterization demonstrated unobstructed epicardial coronary arteries and severely elevated peak pulmonary artery systolic pressure (PASP) of 80 mm Hg. She was reviewed by the cardiothoracic surgeons and turned



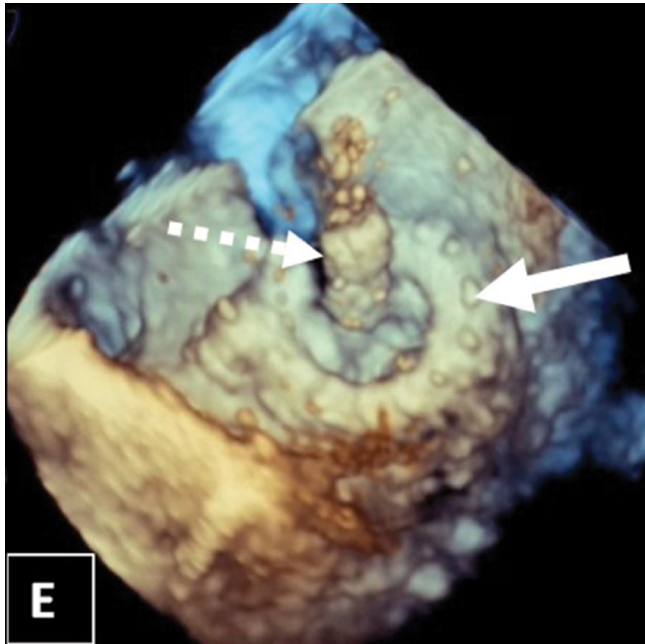
**Figure 4.** A 2D transoesophageal echo (LVOT - view 140 degrees) with the wire across the mitral valve into the left atrium. LV = Left ventricle; LVOT = left ventricular outflow tract; Ao = Aorta.



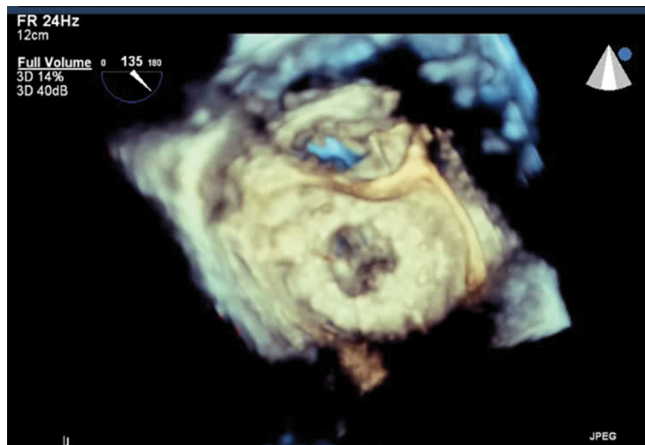
**Video 4.** Live 3D left ventricular view post transcatheter aortic valve implantation in the mitral position. View supplementary video at <http://dx.doi.org/10.12945/j.jshd.2016.002.14.vid.04>.

down for repeat mitral valve surgery due to frailty. The mitral multidisciplinary team decision for transcatheter mitral valve-in-valve implantation was subsequently discussed with the patient who accepted a 10% risk of death or major adverse cardiac event. Sizing of the prosthetic annulus and leaflet area was performed pre-procedure using computed tomography (CT) (Figure 1) and a plan for 26-mm device implantation was made.





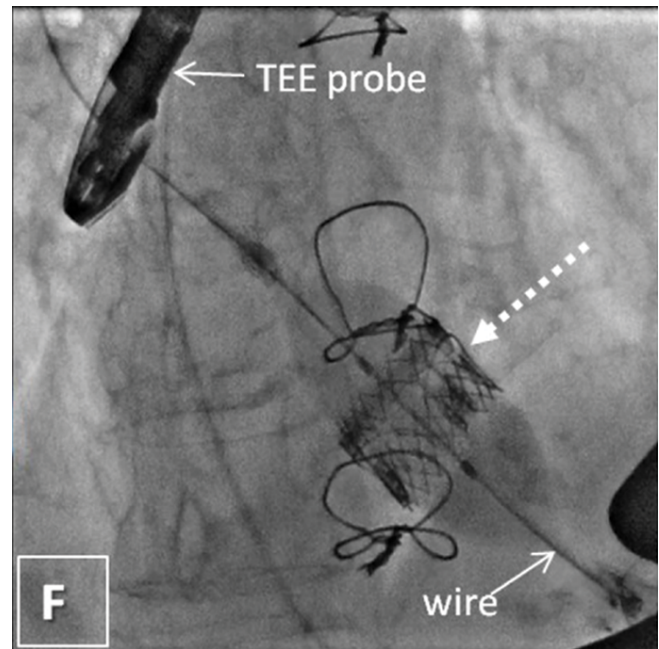
**Figure 5.** Real time 3D zoom transoesophageal echo during position of transcatheter aortic valve implantation in the mitral position. Solid arrow = Mitral valve prosthesis; dashed arrow = 26-mm Edwards TAVI.



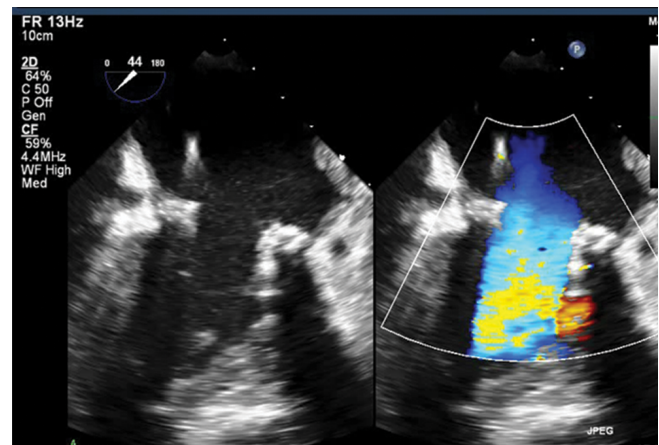
**Video 5.** 3D full volume left atrial view postintervention. View supplementary video at <http://dx.doi.org/10.12945/j.jshd.2016.002.14.vid.05>.

### Procedural Details

A 3D zoom transoesophageal echo (TOE) (left ventricular view) pre-intervention demonstrated severely restricted bioprosthetic leaflet opening (Video 1). Full volume 3D TOE with colour Doppler revealed severe



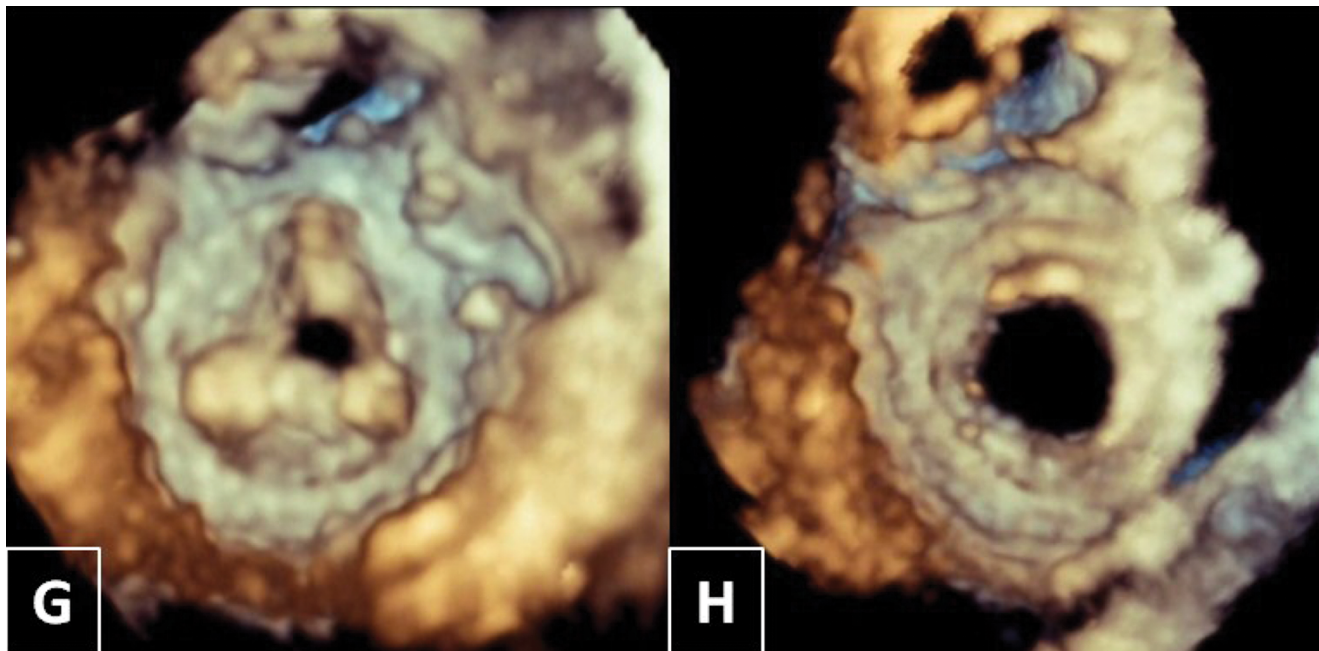
**Figure 6.** Deployment of transcatheter aortic valve implantation (TAVI) in mitral position (fluoroscopy). dashed arrow = 26-mm Edwards TAVI.



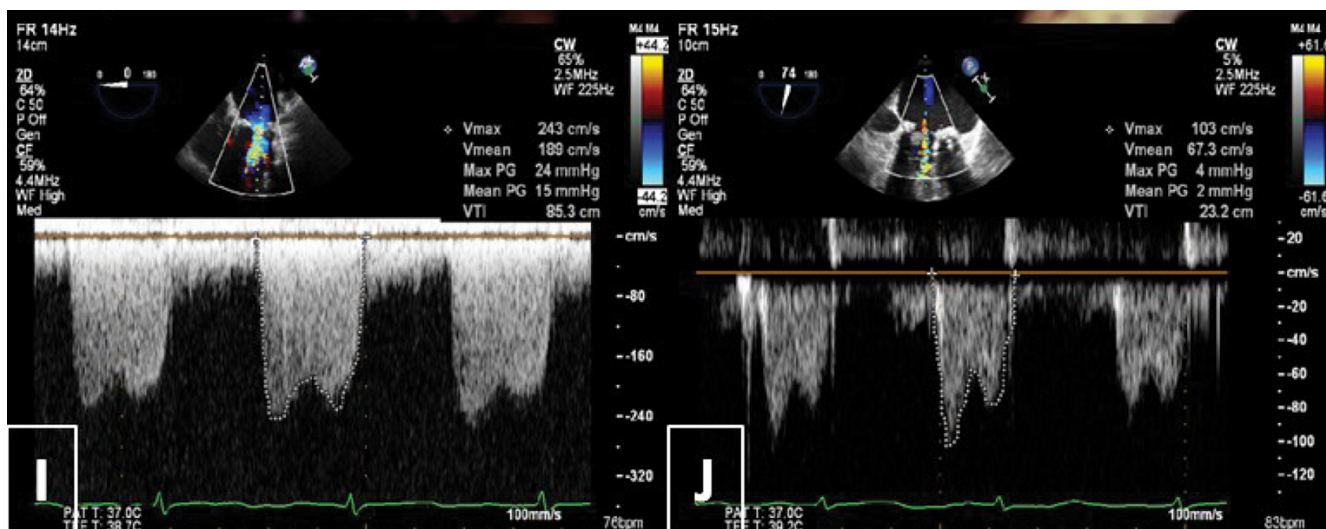
**Video 6.** 2D transoesophageal echo colour compare postintervention, demonstrating good transcatheter aortic valve implantation in mitral position function. View supplementary video at <http://dx.doi.org/10.12945/j.jshd.2016.002.14.vid.06>.

transvalvular mitral prosthesis regurgitation with a broad systolic jet into the left atrial (LA) and flow turbulence on the ventricular side in diastole indicative of severe stenosis of the prosthesis (Figure 2, Figure 3, and Video 2). A temporary pacing wire was inserted via the right internal jugular vein. The procedure was





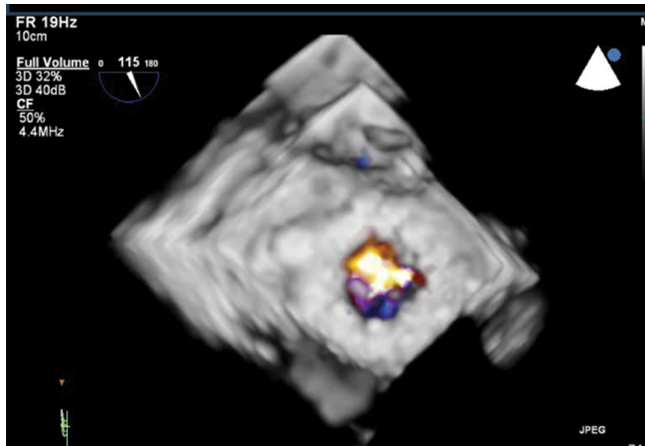
**Figure 7.** Real time 3D zoom (left ventricular view) in diastole, demonstrating the increase in mitral valve area postintervention.



**Figure 8.** Continuous wave Doppler, demonstrating the reduction in mean mitral valve gradient (preintervention 15 mm Hg; postintervention 2 mm Hg).

performed via transapical access with a 6F sheath. A standard J-wire crossed the mitral valve easily with the aid of a pigtail catheter. A 26-mm Edwards XT Ascendra Transcatheter Valve (Edwards Lifesciences, Irvine, California, USA) delivery sheath was positioned across the mitral valve prosthesis, guided by 2D and real time 3D TOE and fluoroscopy (Figure 4, Figure 5, and Video 3). The transcatheter valve was deployed successfully under rapid pacing within the biopro-

thetic ring (Figure 6). A good position was seen on fluoroscopy and 2D and 3D TOE showed only minimal paravalvular leak (Videos 4-7). A significant increase in mitral valve area and reduction in transmitral gradient was observed (Figures 7-8). The patient remained hemodynamically stable throughout the procedure. The temporary wire was removed and the patient was transferred to the cardiothoracic intensive care unit and discharged on day 6 on aspirin and clopido-



**Video 7.** Full volume 3D color Doppler postintervention (left atrial view). View supplementary video at <http://dx.doi.org/10.12945/jjshd.2016.002.14.vid.07>.

grel. She remained well at 6 month review with a well seated valve on transthoracic echocardiography and

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a reduction in estimated pulmonary artery systolic pressure to 46mmHg.

Valve-in-valve implantation, a new technology only possible with state-of-the-art imaging, is a viable treatment option for degenerative tissue bioprosthetic disease in high risk surgical patients. CT is helpful for accurate sizing of the Edwards transcatheter stented valve and detailed periprocedural examination by TOE is needed to define anatomy, guide the procedure and provides immediate assessment of potential complications.

## Conflict of Interest

The authors have no conflicts of interest relevant to this publication.

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