

Percutaneous (Minimally Invasive) Heart Valve Replacement

No more laying your heart bare

by Dr Paul Chiam



THE AORTIC VALVE allows blood to be pumped out of the heart to the rest of the body. With ageing, the aortic valve may become narrowed – a condition known as aortic valve stenosis (AS). When the valve narrowing becomes severe, patients develop breathlessness, fainting spells and chest discomfort. Left untreated, the death rate is high, with up to 50% of patients dying from the condition within two years.

Open heart surgery to replace the aortic valve is the conventional method of treating this disease, relieving patients of their symptoms and prolonging their lifespan. For many elderly patients and patients with other debilitating diseases (e.g. those with very poor heart function, severe lung disease, end stage renal failure on dialysis etc.), the surgical risk for open heart surgery is high, and some patients are even considered inoperable.

TAVR: A New Minimally Invasive Treatment

A relatively novel method of ‘replacing’ this aortic valve was first performed in a human in 2002, as an alternative to open heart aortic valve replacement (AVR) in a “no surgical option” patient, who was too sick to undergo an open heart operation. A small incision was made in the patient’s groin and a new valve was delivered via a catheter (tube) into the heart and implanted within the

patient’s native aortic valve. This technique has been termed “Transcatheter Aortic Valve Replacement/ Implantation” (TAVR/ TAVI) (Figure 1).

Currently, this minimally invasive method is mostly performed via a small puncture in the groin, although in a small number of patients, other access sites are required (via the subclavian artery in the chest, via the aorta directly or through a 5 – 6cm incision in the left chest wall). The groin approach is the least invasive and thus preferred.

Unlike open heart surgery to replace the aortic valve, with TAVR the patient does not need the chest cracked open, the heart is not stopped and the transcatheter heart valve is implanted in a beating heart. Furthermore, the native aortic valve is not removed and the newly implanted transcatheter valve is not sutured in place. The

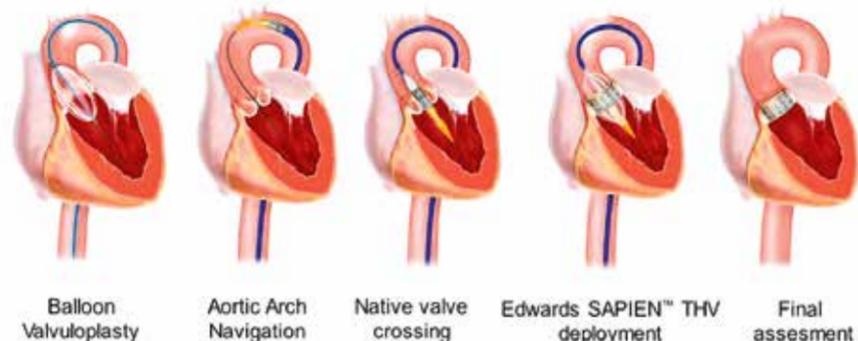


Figure 1. Transcatheter Aortic Valve Replacement/Implantation procedure

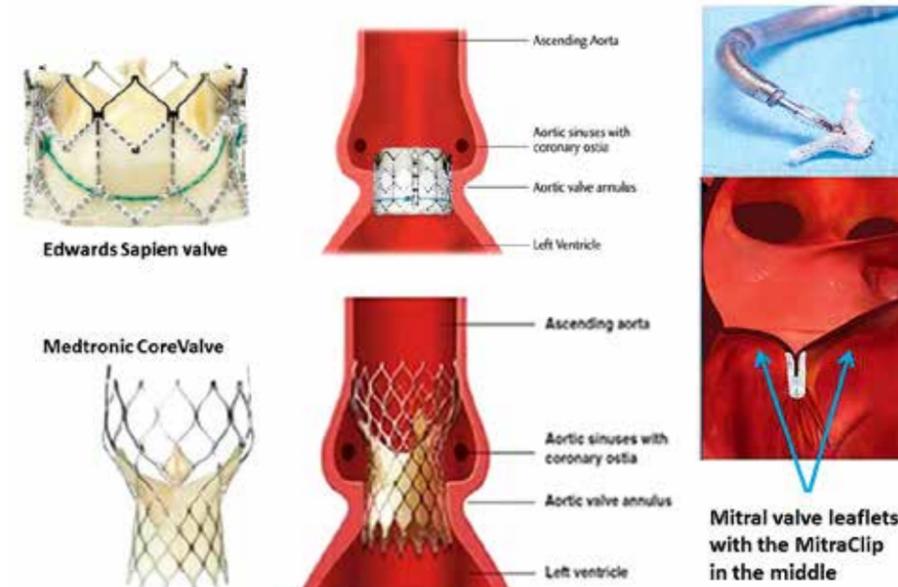


Figure 2.

Figure 3.

procedure can also be done under local anaesthesia for the groin approach.

There are two transcatheter heart valves commonly used: The Sapien XT transcatheter heart valve made by Edwards Lifesciences and the CoreValve made by Medtronic (Figure 2). There are now over 120,000 implants worldwide using these two valves.

Several large randomised studies have shown the promise of this technology. The PARTNER trial (using the Sapien valve) showed that TAVR was superior to (better than) medical therapy in patients with severe aortic valve stenosis (AS) who were inoperable and was non-inferior (equal) to open heart AVR in patients at high surgical risk. Very recently, the CoreValve trial demonstrated that TAVR using the CoreValve was superior to (better than) open heart AVR in high risk patients. Thus, TAVR is now the treatment of choice for inoperable patients and may be a safer treatment option in patients at high surgical risk.

These transcatheter heart valves and their delivery systems continue to be modified and improved, and there are several newer generation transcatheter heart valves being developed. This will reduce procedural complications and improve the outcomes for patients with severe aortic valve stenosis.

The MitraClip Device

Mitral valve regurgitation (MR), also known as leaky mitral valve, is a common valvular abnormality. The mitral valve allows blood to enter the left ventricle where the blood is then pumped out of the heart to the rest of the body. When the mitral valve leaflets cannot close properly, leakage of the blood occurs from the left ventricle into the left atrium (mitral regurgitation) instead of being pumped out to the rest of the body.

Severe MR (leakage) leads to increasing breathlessness and heart failure. Open heart surgery to repair or replace the valve is recommended:

- ♥ when patients experience breathlessness or heart failure due to the severe mitral valve leakage
- ♥ if the heart function becomes impaired
- ♥ if the heart chambers begin to enlarge due to the severe MR

Open chest surgical repair of the valve is preferred where possible over valve replacement as repair produces better long-term outcomes. However, in many patients, usually the very elderly or those with multiple coexisting diseases, open chest mitral valve repair or replacement carries with it a high surgical risk.

A minimally invasive option became available in 2007, where the leaky mitral valve could be ‘repaired’ without the need for open heart surgery. Via a small incision in the groin and on a beating heart, a catheter (tube) is threaded into the heart and directed towards the mitral valve, and a clip (the MitraClip device) is applied to “catch and appose” the two mitral valve leaflets and reduce the leakage (Figure 3).

A randomised trial showed that in patients with symptoms due to severe MR, using the MitraClip device was safer than open chest surgery, although less efficacious at reducing the leakage. However, symptoms and quality of life improvement were similar. As expected, patients undergoing the MitraClip procedure recovered faster and had a shorter hospital stay.

Currently, the MitraClip therapy is used mainly in patients with symptomatic severe MR and at high risk for surgery. It could be considered in patients who truly refuse surgery but only as a very last resort. For younger patients and in patients not at increased surgical risk, conventional open surgery to repair the mitral valve produces superior results and should remain the treatment option of choice. eh

Dr Chiam recently performed Mount Elizabeth Hospital’s first TAVR procedure in an inoperable elderly lady with symptomatic severe aortic valve stenosis. The procedure was successfully performed under local anaesthesia and sedation and she was discharged three days after the procedure.



Dr Paul TL Chiam is an interventional cardiologist at the Heart and Vascular Centre, Mount Elizabeth Medical Centre. He was a senior consultant at the National Heart Centre Singapore (NHCS) and Adjunct Associate Professor at the Duke-NUS Graduate Medical School before he left for private practice. He is trained in complex coronary angioplasty, peripheral arterial and carotid angioplasty and structural (heart valve) interventions. He performed the first TAVR in Asia in 2009, and led the TAVR program at NHCS. He serves as a consultant and proctor to Medtronic CoreValve and Edwards Lifesciences, helping to train and proctor new centres in Asia.