

# Safeguarding the gate to the heart

Researchers at West China Hospital have expanded the use of transcatheter techniques to treat aortic valve disease.

**V**alvular heart disease affects about 25 million people in China and 100 million worldwide every year. Nearly 50% suffer from conditions in aortic valve — the main outflow valve from the heart. Without surgical intervention as many as 50–80% of these patients don't survive more than five years after diagnosis.

Transcatheter aortic valve replacement or implantation (TAVR or TAVI) is a well-established treatment option for elderly patients with severe aortic valve disease. This minimally invasive procedure makes small incisions and inserts a thin, flexible catheter with a prosthetic valve into the heart, providing an alternative to open heart surgery.

TAVI for pure aortic regurgitation (AR) — in which a damaged valve becomes 'leaky' — has remained a major challenge even since TAVI was developed. "In pure AR patients, there is no aortic annulus or leaflet calcification for stable anchoring of a transcatheter heart valve," explains Yingqiang Guo, a professor of cardiac surgery and vice president of West China Hospital of Sichuan University — one of the first in China to perform minimally invasive heart valve surgeries.

## Breakthrough system

Guo leads a team developing the J-Valve™, a next-generation TAVI system with three

U-shaped graspers<sup>1</sup>. "This device clasps the native valve leaflets to provide adequate axial support for the prosthesis, and it solves the anchorage problem," Guo explains.

To facilitate accurate self-positioning of the device, Guo takes a route through the tip of the left ventricle. This reduces the risk of perivalvular leakage and blockage of the electrical signal from the atria to the ventricles, which are problems commonly associated with TAVI procedures for aortic stenosis (AS), the narrowing of heart's aortic valve.

Coronary blood flow blockage is also a rare but lethal complication of TAVI procedure, which the J-Valve may help to prevent. "We designed a shortened stent for the J-Valve and applied horizontal-rotation-realignment technique for its implantation to protect the arteries from occlusion," Guo adds. Since its approval by China Food and Drug Administration in 2017, the J-Valve system has

been used to treat both AR and AS in more than 200 hospitals worldwide.

## TAVI in bicuspid AS

Among elderly AS patients, approximately 50% have a bicuspid aortic valve (BAV). It has been long considered a condition relatively difficult to treat with TAVI due to its complex anatomical features. To solve this, Mao Chen, director of the Cardiology Department, has led a multidisciplinary team to establish a pathway for using TAVI in bicuspid AS patients.

"The trickiest issue is prosthetic valve sizing," says Chen. The team has proposed 'supra-annular structure' concept based on imaging and biomechanics studies. Their 'supra-annular sizing' algorithm<sup>2</sup> has led to more stable valve deployment and optimized interaction between the prosthesis and the aortic root.

"With this new sizing

algorithm, the risk of valve instability and associated complications due to incorrect size selection is reduced in 62.5% of bicuspid AS patients, significantly increasing the device success rate," Chen explains.

To get better results, the team has developed a novel 'reshaping TAVI' technique. In a pilot study, the researchers inflate an hourglass-shaped valvuloplasty balloon to dilate and reshape the BAV more effectively before valve deployment.

Chen is working with industry to develop VenusA-Valve and Venus-PowerX for bicuspid AS patients. As one of the most experienced teams globally in TAVI, they've initiated the PCR-CIT China Chengdu Valves, an annual academic conference to share progress on TAVI treatment since 2015. Recently, the team led the development of the first international expert consensus guideline on TAVI in bicuspid AS patients<sup>3</sup>. ■

## References

- Guo et al., *Annals of Thoracic Surgery* 2020-12110(6):1959-196
- Chen et al., *JACC: Cardiovascular Interventions* 2019 Jun 24;12(12):1164-1171
- Chen et al., *Nature Reviews Cardiology* (2022)



Yingqiang Guo (at left) and Mao Chen perform TAVI procedures.