3D printing technology reduces risks of TAVR complications

Transcatheter aortic valve replacement (TAVR) is a procedure used for intermediate, high-risk, and inoperable patients with severe narrowing of the aortic valve where a prosthetic valve is implanted and the damaged valve is replaced. A common risk of TAVR is an ill-fitting valve which can lead to paravalvular leak (PVL). New research shows 3D printing technology could help find and prevent these leaks from happening. The retrospective study was presented at the Society for Cardiovascular Angiography and Interventions (SCAI) 2018 Scientific Sessions.

More than five million Americans are diagnosed with heart valve disease each year. TAVR is a less invasive procedure to replace the heart's aortic valve, but patients who undergo this procedure can experience paravalvular leak around the new valve which can lead to higher mortality rates. 3D printing has become more popular within the medical space as it has been discovered to be a vital tool to prevent, fix and foresee procedural errors.

In the study, six patients undergoing TAVR for severe, calcific aortic stenosis and at risk for paravalvular leak had pre-procedure computed tomography (CT) images analysed and segmented for printing of 3D models. The CT scans allowed researchers to see a 360-degree view of the location of the calcium build up while the 3D models allowed researchers to further evaluate the ill-fitting valves. The 3D aortic root models were then implanted with the valve to determine if the size was correct, ultimately revealing where the calcium composites would be. The 3D models were scanned, evaluated for final analysis and then compared to in-vivo implanted TAVR echocardiograms.

Notably, every leak seen on the 3D models was confirmed on the CT digital scans. The 3D models enabled researchers to use prototypes to personalise valve placement, size and location to stop leaks and lower calcium build up.

"We are very encouraged to see such positive outcomes for the feasibility of 3D printing in patients with heart valve disease. These patients are at a high risk of developing a leak after TAVR, and anything we can do to identify and prevent these leaks from happening is certainly helpful," explains lead author Sergey Gurevich, MD, and Cardiovascular Fellow at the University of Minnesota. "Like any other new technology, as 3D printing evolves, we hope to see an increase in accessibility and opportunity for the use of this technology to help improve patient care."

Dr. Gurevich and co-authors say a functional study is needed to help determine the exact size of the leak. They are working with computational fluid dynamics to optimise calculations.

Source: Society for Cardiovascular Angiography and Interventions
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