

# THE HEART COMES FIRST

Photographs by Cezary Piwowski

Transcatheter valve replacement often saves patients' lives. The procedure has become relatively safe and very effective, and may soon become common practice.





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**T**he treatment of valvular heart disease has long been the domain of cardiac surgery. However, surgical procedures carried too great a risk of death or major complications for many patients due to their age or comorbidities (such as ischemic heart disease, lung diseases, kidney diseases, and so on). It is estimated that even 30–40% of patients with severe acquired aortic stenosis, which affects around 5% of the population over the age of 75, were not eligible for surgical treatment. Unfortunately, after the onset of clinical symptoms such as shortness of breath and fainting, aortic stenosis relatively quickly leads to death. Moreover, here pharmacotherapy is not very effective.

**Surgery or transcatheter procedure?**

In such patients, the best treatment involves replacing the defective aortic valve through a blood vessel using a catheter. This procedure, called transcatheter aortic

valve implantation (TAVI), was first performed by the French cardiologist Alain Cribier in 2002. Cribier opened up a new era of non-surgical treatment of valvular heart disease, which marked a true turning point in medicine. Initially, TAVI procedures were performed on patients who were deemed unsuited for surgery. However, as more and more findings of consecutive studies comparing the safety and efficacy of TAVI procedures and surgical aortic valve replacement came to be published, the assessment of surgical risk receded into the background, thus allowing more procedures to be performed.

The valves used for TAVI procedures are bioprosthetic valves with leaflets made from bovine or porcine pericardium. Such valves are attached to a stent, which can be self-expandable (a nitinol stent) or balloon-expandable (a cobalt-chromium stent). Currently, according to the guidelines of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS), TAVI procedures are preferable in older patients, over 75 years of age, especially if they can be performed via the transfemoral approach (the catheter is inserted through the femoral artery). Surgical aortic valve replacement is still the treatment of choice in younger patients, except for those at increased surgical risk (due to comorbidities). In such special cases, the decision is made by a team consisting of an interventional cardiologist, a cardiac surgeon, a clinical cardiologist, and often doctors

Photo 1  
Maciej Dąbrowski, PhD, MD,  
preparing for a TAVI  
procedure

Photo 2  
Prof. Adam Witkowski, PhD,  
MD, preparing for a TAVI  
procedure





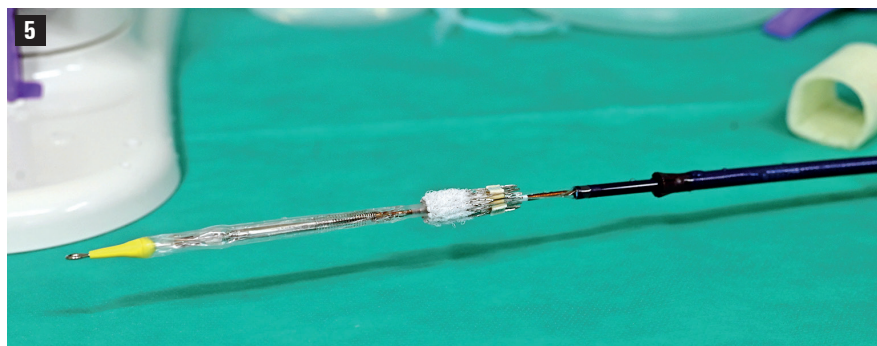
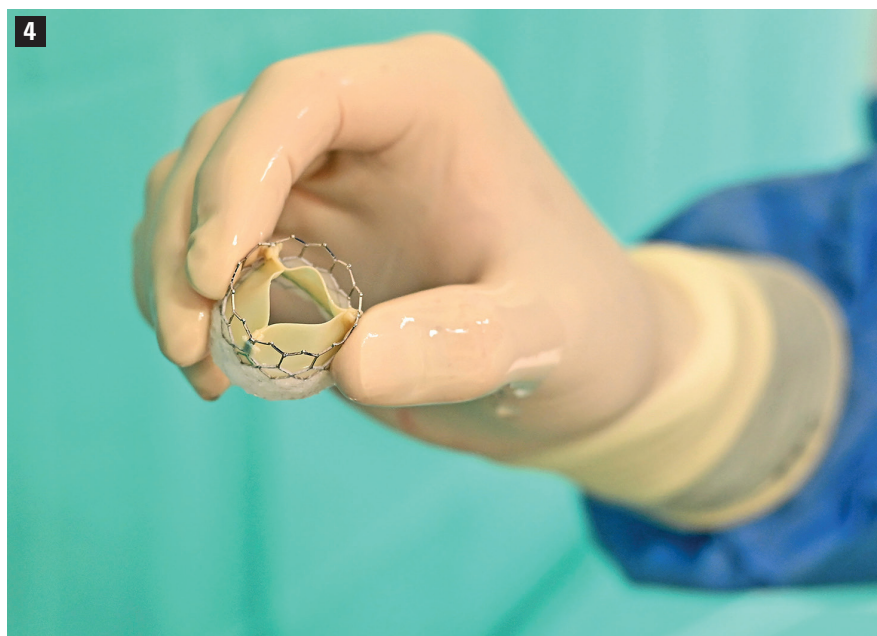


Photo 3  
S3 Ultra bioprosthesis valve (Edwards Lifesciences, CA 92614, United States) implanted into the stenotic aortic valve

Photo 4  
S3 Ultra bioprosthesis valve (Edwards Lifesciences, CA 92614, USA) before being placed on the delivery system. We can see the leaflets made of bovine pericardium suspended in a cobalt-chromium alloy stent together with an outer sealing skirt to prevent paravalvular leaks

Photo 5  
The delivery system with the S3 Ultra valve mounted and crimped, and with the balloon onto which the valve is slid inside the patient's aorta

Photo 6  
Operators during the TAVI procedure



representing other specialties. Nowadays, TAVI procedures are also increasingly likely to be performed in patients after a surgical aortic valve replacement. Such procedures are safer than re-doing surgery and equally effective.

In Western Europe and in the United States, the number of TAVI procedures first exceeded the number of surgical aortic valve replacements in 2018. In Poland, access to these procedures remains limited, despite the fact that they are the best treatment for older patients with severe aortic stenosis and are life-saving procedures. Nevertheless, the number of patients is growing every year. In 2021, 2050 TAVI procedures were performed, which translates into 54 procedures per million people. The ESC estimates that

every year between 7,000 and 10,000 procedures are needed in Poland. TAVI procedures also carry a risk of complications, most commonly blood vessel injury and bleeding (9–20%) and the need to implant a permanent pacemaker (10–20%).

The mitral valve

Diseases affecting the mitral valve, which lies between the left atrium and the left ventricle, primarily include mitral regurgitation. This phenomenon can be divided into: (1) primary regurgitation, caused by the degeneration of the leaflets; (2) secondary (functional) regurgitation, which occurs in patients with heart failure, and (3) a combination of primary and secondary

Photo 7  
Operators during the TAVI procedure

Photo 8  
Monitors used during the TAVI procedure to observe the ECG and blood pressure (the top left screen), and the echocardiogram usually performed after the valve implantation is completed (the top right screen), angiographic images of the heart and the aorta (the bottom left screen) and the femoral and iliac arteries (the bottom right screen).

The bottom left screen shows the TAVI procedure in real time and is the main source of information for the operators







Photo 9  
Operator during the TAVI procedure

Photo 10  
The operator fills in the pump, which will be connected to the bioprosthesis delivery system

regurgitation. Mitral regurgitation contributes to the development or worsening of clinical symptoms of heart failure, such as shortness of breath or pulmonary edema, as blood leaks backward into the left atrium during the contraction (systole) of the left ventricle, causing blood to back up into the lungs.

In the treatment of functional regurgitation in selected patients, doctors prefer transcatheter procedures using the edge-to-edge method, which involves placing one or more clips on the leaflets. The clipping device is inserted into the patient's body through the femoral vein. The COAPT randomized trial comparing optimal drug treatment with the transcatheter implantation of clips in patients with heart failure and secondary mitral regurgitation confirmed the high efficacy of this method.

In Poland, the situation does not look very good: despite a very high demand for edge-to-edge procedures, only slightly over 200 of them are performed annually, due to very restrictive reimbursement.

## The tricuspid valve

Tricuspid regurgitation is the most common heart valve pathology. Trace or mild tricuspid regurgitation was found in 70% of people in a study involving 33,000 patients. The incidence of tricuspid regurgitation increases with age. Functional tricuspid regurgitation is usually caused by right ventricular overload

and dilatation secondary to left ventricular damage (resulting for example from coronary artery disease, cardiomyopathy, or aortic and mitral valve pathologies). In addition, this type of tricuspid regurgitation may result from pulmonary hypertension and atrial fibrillation. Primary regurgitation is a lot less common (it is found in about 15% of patients), and it is most commonly caused by infective endocarditis. Currently, surgical treatment consists of tricuspid valve repair, usually involving the insertion of a rigid ring. As the disease progresses and patients get older, surgical treatment brings unsatisfactory results. In recent years, transcatheter treatment of tricuspid regurgitation has been therefore used in more and more patients at increased surgical risk. Transcatheter tricuspid regurgitation reduction procedures in Poland are currently not reimbursed by the National Health Fund (NFZ); they can be performed if individual approval is obtained from a regional branch of the NFZ. Valve implantation procedures in patients with tricuspid regurgitation in Poland and abroad are currently only possible in clinical trials.

Transcatheter valve implantation procedures in patients with MR and TR are undoubtedly a milestone in medicine, as they offer hope for a dignified life to many patients. It seems only a matter of time, probably a few years, before they start to be used commonly in clinical practice – just as has been the case with TAVI. ■

### Further reading:

Vahanian A., Beyersdorf F., Praz F. et al., 2021 ESC/EACTS Guidelines for the management of valvular heart disease: Developed by the Task Force for the management of valvular heart disease of the European Society of Cardiology (ESC) and the European Association for Cardio-Thoracic Surgery (EACTS), *European Heart Journal* 43/2022.

Witkowski A., Dudek D., Bartuś S. et al., Innovative medical technologies in the percutaneous treatment of tricuspid regurgitation in Poland, *Cardiology Journal* 29/2022.

Baumgartner H., De Backer J., Babu-Narayan S.V. et al., 2020 ESC Guidelines for the management of adult congenital heart disease, *European Heart Journal* 42/2021.