

# **Anatomical and imaging aspects of the cardiac valves in aortic valvular cardiomyopathies**

## **Doctoral thesis abstract**

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Transcatheter aortic valve implantation (TAVI) has revolutionized the management of severe aortic stenosis (AS), expanding therapeutic options for this condition. Initially used only in patients at extremely high surgical risk, TAVI rapidly evolved from a niche procedure into a routine treatment for a broad spectrum of patients with severe AS. Numerous randomized clinical trials conducted in high-, intermediate-, and low-surgical-risk groups have shown that TAVI provides clinical benefits comparable to surgical aortic valve replacement (SAVR), improving survival and quality of life. This evidence led to the inclusion of TAVI in current guidelines as a first-line option for the treatment of severe AS. At present, TAVI is mainly considered in elderly patients and in those with increased operative risk, improving their access to effective therapy for an otherwise fatal disease. Thus, the use of TAVI in patients with severe AS has a strong clinical and scientific rationale and represents a major area of interest in contemporary cardiology research. As indications for TAVI expand to younger patients with lower risk and longer life expectancy, it becomes essential to optimize the procedure and minimize periprocedural complications in order to maintain long-term benefits. However, despite continuous technological advances in valve design and interventional techniques, TAVI is associated with significant periprocedural risks, and long-term outcomes remain uncertain. To address these gaps in the literature, we conducted the following studies as part of the doctoral research:

**Study I** – Predictors of acute complications after TAVI. The objective of this study was to identify clinical, anatomical, and procedural factors associated with acute in-hospital events. In this study, we showed that a relatively high rate of acute complications is typical for TAVI, but most acute complications can be successfully treated, and in-hospital mortality is low. Clinical parameters such as diabetes mellitus, left bundle branch block, or left ventricular diameter, and anatomical parameters such as the height of the left coronary artery ostium and the height of the sinotubular junction, were predictive factors for acute post-TAVI complications. Periprocedural characteristics such as the maximal transprosthetic gradient and the use of the Portico/Navitor valve platform were also associated with the occurrence of acute complications.

**Study II** – Determinants of long-term survival after TAVI. The objective of this study was to compare survival and major events according to clinical profile, valve type (balloon-expandable or self-expanding), and the use of pre-dilatation/post-dilatation. This study is the first long-term survival analysis from Romania, reporting all-cause and cardiovascular mortality rates comparable to other Western registries and randomized trials. In univariable analysis, balloon-expandable valves were associated with higher

survival than self-expanding valves, and the use of post-dilatation was associated with lower survival, while the use of pre-dilatation did not influence survival. However, in multivariable analysis, survival was affected by clinical parameters such as the presence of complex coronary artery disease and atrial fibrillation, the need for intensive care, and higher serum creatinine, while post-dilatation showed only a trend toward increased mortality without reaching the threshold of statistical significance.

**Study III** – TAVI versus SAVR: clinical outcomes and cost-effectiveness. The objective of this study was to compare clinical outcomes and direct medical costs between TAVI and SAVR, in order to define the most cost-effective strategies by surgical risk categories. A separate analysis was also performed in patients with concomitant coronary artery disease, stratified according to the presence of concomitant percutaneous coronary intervention (PCI) or coronary artery bypass grafting (CABG). In this study, we showed that in patients at high surgical risk due to advanced age and comorbidities, TAVI is more cost-effective than SAVR, and TAVI+PCI is more cost-effective than SAVR+CABG. This benefit is related to lower procedural and in-hospital mortality in the interventional treatment group (TAVI and TAVI+PCI, respectively) in high-risk patients. However, in patients without high surgical risk (those at intermediate or low risk), SAVR is more cost-effective than TAVI, and SAVR+CABG is more cost-effective than TAVI+PCI. While other studies have shown similar hospitalization costs between TAVI and SAVR, in our study hospitalization costs for TAVI were more than €20,000 higher than for SAVR, because the difference in procedural costs was also reflected in the total hospitalization cost.

**Study IV** – Artificial intelligence for predicting post-TAVI survival. The objective of this study was to identify predictors of adverse events after TAVI using artificial intelligence techniques. Identifying predictive factors, especially modifiable ones, for impaired survival after TAVI in symptomatic severe AS is an important goal in contemporary cardiovascular medicine, as post-TAVI mortality is still relatively high. Assessment of inflammatory status could provide such predictive factors. In our study, artificial intelligence models identified C-reactive protein, the neutrophil-to-lymphocyte ratio, leukocyte count, and fibrinogen as important variables for adverse events.

This work presents several original contributions: (1) The studies in this thesis report for the first time in Romania the long-term outcomes of valvular patients treated either with TAVI or surgically with SAVR. (2) The studies benefited from precise patient follow-up. All included patients signed informed consent for long-term follow-up for scientific purposes as part of the institutional protocol. (3) The studies included a large number of patients treated with TAVI, describing the largest cohort of patients with severe aortic stenosis in Romania. (4) The results and conclusions of the studies have practical implications.