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EDITORIAL

A Novel Prediction Model for Post-TAVI MACCE Based on Extracellular Vesicles Concentration Analysis

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Aortic stenosis (AS), the most common valvular heart disease, is typically with a prolonged asymptomatic period. However, once symptoms manifest, the condition progresses rapidly. Patients experiencing symptoms such as angina, heart failure, or syncope face a very high risk of sudden death. The prevalence of AS is age-related, affecting about 0.2% of people in their 50 s, and rising to 9.8% in those in their 80 s. Transcatheter aortic valve implantation (TAVI) has revolutionized the treatment landscape for AS, particularly benefiting elderly patients by significantly reducing mortality and improving quality of life compared to conservative treatments [1]. Despite these advancements, a subset of patients still experience major adverse cardiac and cerebrovascular events (MACCE) within the first year post-TAVI. Current assessment tools tend to underestimate the risk of MACCE after TAVI treatment, especially in high-risk patients. Thus, there is a critical need for novel predictive models that more accurately forecast MACCE risks post-TAVI.

Extracellular vesicles (EVs) are membranous vesicles released by various types of cells into several bodily fluids like blood and urine. They are pivotal in the pathogenesis and progression of numerous cardiovascular diseases. Circulating EVs hold promise as potential biomarkers due to their involvement in conditions such as atherosclerosis and aortic stenosis [2]. However, their specific role in predicting MACCE post-TAVI remains to be clarified. A recent study by Aleksandra Gąsecka and colleagues, entitled "Extracellular vesicles to predict outcomes after transcatheter aortic valve implantation-a prospective, multicenter cohort study", addresses this gap. It is the first to explore how plasma concentrations of EVs change with TAVI and their predictive value for MACCE risks. The study involved collecting samples of patients diagnosed with severe AS and eligible for TAVI, based on the November 2018 Guidelines for the Management of Valvular Heart Disease, through June 2020. Exclusion criteria included patients with chronic kidney disease (glomerular filtration rate < 30 mL/min), autoimmune diseases, active cancer, and those pregnant or breastfeeding. Clinical data and echocardiography outcomes were collected at 12 ± 3 months post-TAVI, along with information on MACCE occurrences. The researchers utilized flow cytometry to analyze various EV subtypes and observed a decrease in EVs from leukocytes (CD45 +) post-TAVI compared to baseline. Furthermore, higher baseline concentrations of leukocyte EVs (CD45 +) were noted in patients who later experienced MACCE. There was also a trend toward

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higher pre-TAVI concentrations of PS-exposed EVs (PS^+), and post-TAVI EVs from erythrocytes ($CD235a^+$) in patients who suffered MACCE. Notably, the concentrations of pre-TAVI leukocyte EVs, pre-TAVI PS + EVs, and post-TAVI erythrocyte EVs were all predictive of MACCE. Specifically, patients with elevated pre-TAVI concentrations of PS^+EVs had a more than fivefold increased risk of adverse outcomes post-TAVI. Additionally, compared to patients with lower concentrations of PS^+EVs, those with high concentrations had a decreased chance of event-free survival.

In summary, this study reveals that TAVI leads to a decrease in plasma concentrations of EVs derived from leukocytes ($CD45^+$). Moreover, patients with elevated pre-TAVI concentrations of PS^+EVs face over five times the odds of adverse post-TAVI outcomes during the median observation time. This research introduces a novel predictive model for post-TAVI MACCE based on EV concentration analysis.

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Declarations

Research Involving Human Participants and/or Animals This article does not contain any studies with human participants or animals performed by any authors.

Informed Consent This article does not contain any studies with human participants.

Conflict of Interest Junjie Xiao is an editor of Journal of Cardiovascular Translational Research. The other authors declare no competing interests.

References

1. Boskovski MT, Gleason TG. Current Therapeutic Options in Aortic Stenosis. Circ Res. 2021;128(9):1398–417.
2. Blaser MC, et al. Multiomics of Tissue Extracellular Vesicles Identifies Unique Modulators of Atherosclerosis and Calcific Aortic Valve Stenosis. Circulation. 2023;148(8):661–78.