



Staging complex pulmonary and right heart problems in mitral annular calcification with mitral valve dysfunction

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This study classified the severity of mitral annular calcification (MAC) based on mitral valve dysfunction (MVD) and extracardiac damage using echocardiography (1). Al-Abcha *et al.* developed a novel staging system for patients with significant mitral regurgitation (MR) and/or mitral stenosis (MS). The combined assessment of MAC and right ventricular (RV) dysfunction is particularly unique and informative. Moreover, this staging system appears to hold prognostic value. The majority (98.4%) of patients with MVD associated with MAC exhibited extracardiac damage, and patients in higher stages were associated with increased mortality and heart failure-related hospitalizations. In higher staged group, patients with severe tricuspid regurgitation or RV dysfunction showed higher mortality and hospitalization rates. Interestingly, there was no significant difference in mitral valve area (MVA) or MR volume across the stages. This result may be attributable to the tendency of Stage 4 patients to have larger left atrial volumes and lower left ventricular ejection fractions. Additionally, atrial fibrillation (AF) was present in 73.3% of Stage 4 cases. Long-term persistent AF likely contributed to enlargement of the mitral and tricuspid annuli, leading to severe regurgitation and biventricular dysfunction. Patients in Stages 3 and 4 had significant pulmonary hypertension with RV systolic pressure over 50

mmHg, indicating that lung function and/or pulmonary circulation impairment, also influence the prognosis in these patients with MVD associated with MAC. The great advantage of the MAC staging system was predictable even without analyzing the detailed results, accurately summarizing phenomena observed daily in clinical practice. The interesting finding of this study was that there was no significant difference in prognosis between predominant MR and predominant MS in patients with combined MS and MR associated with MAC. This is a new and noteworthy insight. We postulate the reason why we must consider extracardiac damages as well as MVD is the followings: firstly, the quantitative assessment is challenging in MVD with MAC (2). Secondly, more impairment of pulmonary circulation and/or RV systolic function may occur than we expect, caused by MVD with MAC (3). Probably, pulmonary vascular impairment as well as secondary pulmonary hypertension may occur. Finally, most of this population is elderly patients; therefore, complicated MVD with MAC and multi-organ diseases are high risk factors for invasive treatments (4).

Degenerative MS accounts for 12–26% of all MS cases, with a prevalence of 10% in those in their 60s and 60% in those over 80 years old (5). The presence of MAC increases the operative mortality rates sixfold in patients undergoing

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isolated mitral valve surgery (6). This study reaffirmed that chronic AF and right ventricle-pulmonary artery coupling dysfunction are more critical determinants of outcomes than the severity of mitral valve disease itself.

The presence of AF in patients with mitral valve disease is associated with elevated left atrial pressure, leading to post-capillary pulmonary hypertension and progression of heart failure (7). Patients with MR and pulmonary hypertension have high mortality rates, with 5-year survival rates decreasing from 39.7% to 79.8% as the severity of pulmonary hypertension increases (8). Surgical outcomes for pulmonary hypertension patients undergoing mitral valve surgery are notably poor, with an observed all-cause mortality rate of 13% (9). The limitations of this study include being a single-center study with a cohort lacking racial diversity, and additionally, group 0–1 had a very small number of patients compared to the other groups. This may impact the results as group 0–1 was treated as the reference in their regression analysis. Additionally, it is difficult to ascertain if the left ventricle and left atrium myopathy is secondary to MAC or due to comorbidities. Most patients were elderly with chronic kidney disease, congestive heart failure, hypertension, and other conditions, which are expected to result in larger left atrial sizes and a higher prevalence of AF. Moreover, despite best efforts, residual confounding may impact the association of MAC stages with mortality. This is especially important as the same authors have previously shown that severe stenosis (MVA <1.5 cm²) is associated with mortality (10). However, in the current study, all MAC stages exhibited similar MVA. Given that the MAC staging system does not account for factors such as age, medication status, or the presence of dialysis, further investigation is necessary for predicting prognosis. In high-risk elderly patients in MVD with MAC, more extracardiac damages as well as conventional mitral parameters should be considered to decide the indication for invasive treatments.

Overall, the MAC staging system allows for more accurate and comprehensive prognostic prediction and treatment strategy optimization for patients with MAC. It provides clinicians with a new standard for assessing risk in MAC patients and suggests the need to reconsider treatment strategies for high-risk patients. The results of this research are expected to provide new insights for clinical decision-making and preventive strategies in the increasing number of transcatheter mitral valve replacement procedures worldwide.

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