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Patrizio Lancellotti

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INTRODUCTION

Heart failure, structural heart disease and emerging cardiovascular risk markers

Patrizio Lancellotti

Department of Cardiology, University of Liège Hospital, GIGA Institute, CHU Sart Tilman, Liège, Belgium

ABSTRACT

Cardiovascular medicine is progressively evolving towards a more personalised approach integrating advanced imaging, haemodynamic assessment, biomarkers, rehabilitation, and digital technologies. The studies featured in this issue of *Acta Cardiologica* provide new insights into heart failure, structural heart disease, coronary artery disease, congenital heart disease, and cardiovascular prevention. Collectively, they highlight the growing importance of comprehensive risk stratification and individualised management strategies to improve cardiovascular outcomes.

KEYWORDS

Heart failure; risk stratification; structural heart disease; precision cardiovascular medicine

This issue of *Acta Cardiologica* is devoted to several important and rapidly evolving areas of cardiovascular medicine, including heart failure (HF), structural heart disease, coronary artery disease, congenital heart disease, cardiovascular prevention, and emerging digital technologies. Despite major advances in diagnosis and treatment, cardiovascular diseases remain the leading cause of morbidity and mortality worldwide. Improving risk stratification and tailoring therapeutic strategies to individual patient characteristics have therefore become central objectives of contemporary cardiovascular practice. The studies published in this issue illustrate how novel biomarkers, advanced imaging techniques, haemodynamic assessment, rehabilitation programs, artificial intelligence, and innovative interventional approaches are progressively reshaping cardiovascular care.

HF remains one of the most challenging cardiovascular syndromes because of its clinical heterogeneity and high burden of hospitalisation and mortality. The distinction between HF with reduced ejection fraction (HFrEF) and HF with preserved ejection fraction (HFpEF) is increasingly recognised as fundamental for patient management. In a large multicentre study including more than 2000 patients, Belopavlović et al. confirmed substantial differences between these two phenotypes [1]. Patients with HFpEF were older, predominantly female, and more frequently affected by hypertension, obesity, and atrial fibrillation, whereas HFrEF patients showed greater ventricular remodelling and higher biomarker levels. These observations reinforce the concept that HFrEF and HFpEF represent distinct clinical entities requiring individualised therapeutic approaches.

Beyond ejection fraction, the assessment of patient vulnerability is becoming increasingly important. Arévalo Lorigo et al. examined the complex relationship between sarcopenia and frailty in patients hospitalised for acute HF [2]. Although these syndromes are often considered interchangeable, their study demonstrated important

differences. Frailty was predominantly associated with cognitive dysfunction, malnutrition, and reduced autonomy, whereas sarcopenia was more closely linked to congestion and emerged as an independent predictor of early readmission. In an accompanying editorial, Devrikis et al. emphasised that body composition abnormalities extend beyond sarcopenia alone and highlighted the underrecognised contribution of adiposity to patient vulnerability [3]. Together, these studies support a more comprehensive evaluation of functional status in HF patients.

The therapeutic implications of these observations are illustrated by the randomised trial conducted by Sönmez et al. evaluating exercise-based rehabilitation in stable HF patients [4]. Both high-intensity interval training and moderate continuous training significantly improved exercise capacity, muscle strength, and quality of life. Interestingly, these clinical benefits were not accompanied by measurable changes in circulating myostatin or brain-derived neurotrophic factor levels, suggesting that additional biological mechanisms may contribute to the favourable effects of exercise rehabilitation.

The importance of serial assessment after hospitalisation is highlighted by the study of Salvador-Casabón et al. [5]. In patients recently discharged after acute HF, advanced echocardiographic parameters including global longitudinal strain and right ventricular free-wall strain provided important prognostic information beyond conventional measurements. Notably, determinants of prognosis differed according to HF phenotype, emphasising once again the complexity of HF pathophysiology and the need for individualised follow-up strategies.

Additional insights into acute HF were provided by Miró et al. who investigated factors associated with adverse outcomes in hypertensive acute HF (Figure 1) [6]. Age remained the strongest determinant of mortality, while chronic obstructive pulmonary disease and ischaemic heart disease contributed significantly to early

Hypertensive acute heart failure

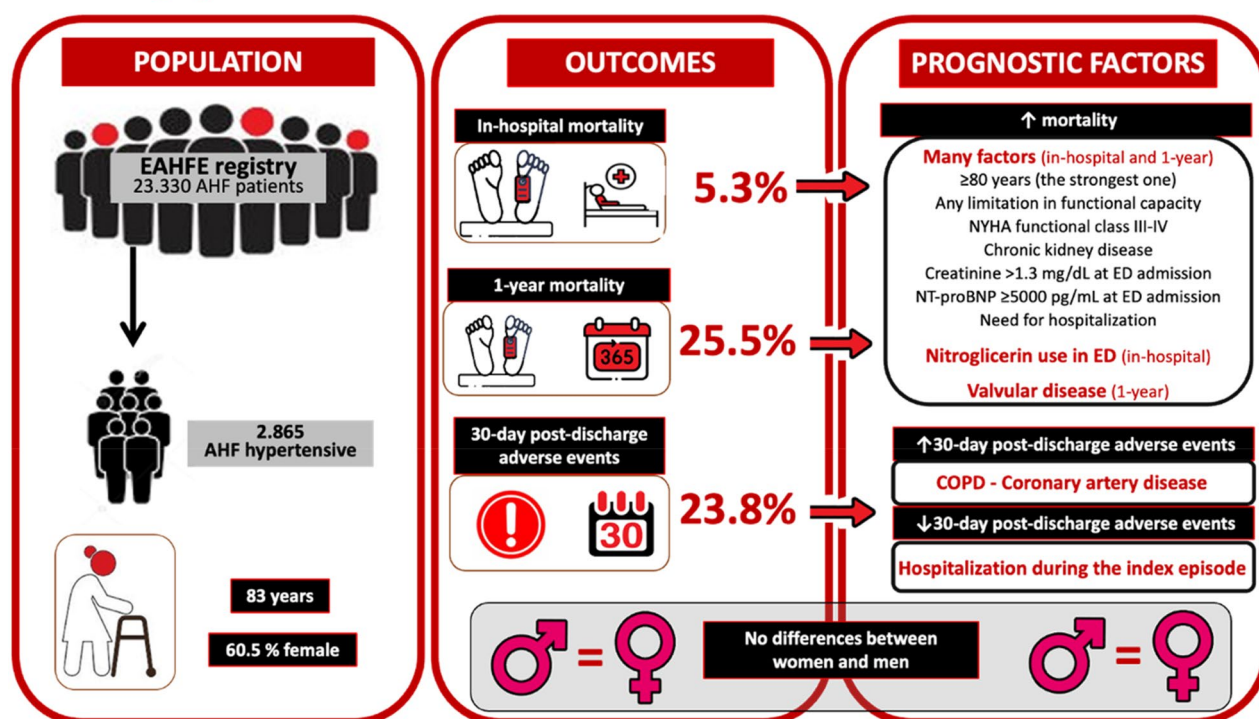


Figure 1. Clinical profile, outcomes, and prognostic factors in patients with hypertensive acute heart failure. Among 2865 patients from the EAHFE registry, in-hospital mortality was 5.3%, one-year mortality 23.8%, and 30-day post-discharge adverse events 25.5%. Multiple factors were associated with mortality and adverse events, with no significant sex-related differences in outcomes. AHF: acute heart failure; EAHFE: Epidemiology of Acute Heart Failure in Emergency Departments (from reference [6]).

post-discharge events. Interestingly, intravenous nitroglycerine administration was associated with increased in-hospital mortality. Although causality cannot be inferred from observational data, these findings highlight the need for further investigation regarding therapeutic strategies in this common clinical scenario.

Artificial intelligence is rapidly entering clinical medicine and may soon influence cardiovascular decision-making. Alnuwaysir et al. evaluated ChatGPT-5 using real-world HF clinical scenarios and compared its recommendations with contemporary guidelines [7]. Although approximately half of the responses were fully concordant with guideline recommendations, clinically relevant inaccuracies and potentially unsafe suggestions remained frequent. These results illustrate both the considerable promise and current limitations of large language models and reinforce the need for continued physician oversight.

Structural heart disease continues to be one of the most dynamic fields in cardiovascular medicine. Right-heart haemodynamics have emerged as important determinants of outcome following transcatheter aortic valve implantation (TAVI). In an accompanying editorial, Çelik and Kalçık discuss the growing importance of integrating pulmonary artery pulsatility index (PAPi) and pulmonary arterial capacitance (PAC) into clinical evaluation [8]. The original study by Ozaki et al. demonstrated that patients presenting with both low PAPi and low PAC experienced significantly worse outcomes following TAVI

[9]. These findings suggest that comprehensive haemodynamic profiling may provide incremental prognostic information beyond conventional left-sided parameters.

The progressive expansion of TAVI into increasingly complex anatomical settings is illustrated by the multicentre study of Assal et al. evaluating bicuspid aortic valve stenosis (Figure 2) [10]. Historically considered challenging for transcatheter treatment, bicuspid anatomy was associated with procedural outcomes comparable to those observed in tricuspid valves when contemporary devices and careful preprocedural planning were employed. These encouraging results support the growing role of TAVI in selected bicuspid valve patients.

Novel biomarkers continue to provide important prognostic information across a broad range of cardiovascular diseases. Decotto et al. demonstrated that serum albumin represents a powerful predictor of mortality in patients with wild-type transthyretin cardiac amyloidosis [11]. Lower albumin levels were associated with substantially increased mortality despite adjustment for conventional prognostic variables. Because serum albumin is inexpensive and widely available, these findings may have immediate clinical implications.

Another unique population investigated in this issue includes patients with β -thalassaemia and pulmonary hypertension. Moghadas et al. demonstrated significant improvements in exercise capacity and right ventricular function following guideline-directed treatment [12].

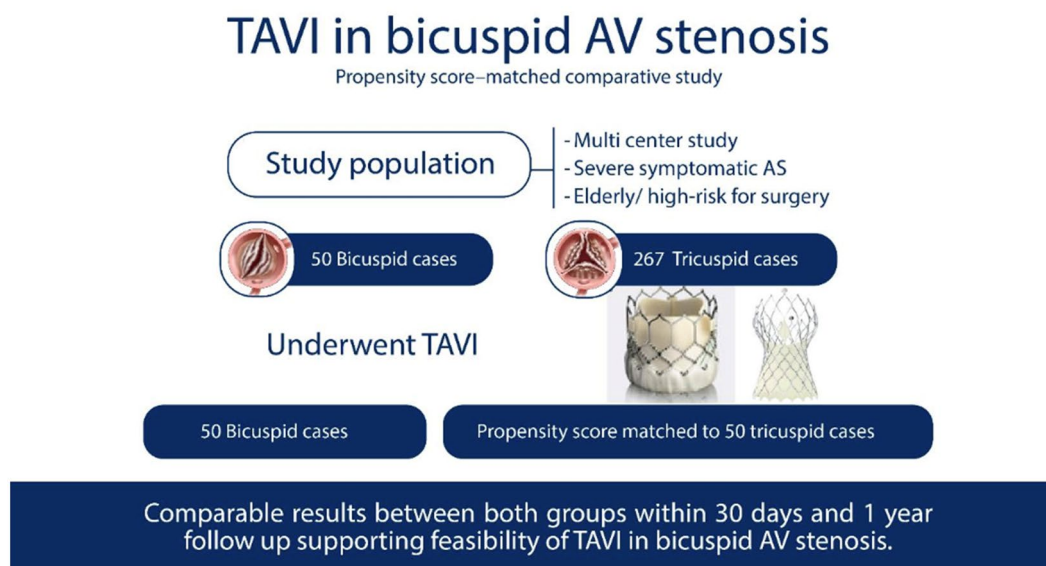


Figure 2. Study design and main findings of the propensity score-matched comparison between bicuspid and tricuspid aortic valve stenosis patients undergoing TAVI. Despite greater anatomical complexity, bicuspid valve patients achieved comparable 30-day and 1-year outcomes to matched tricuspid valve patients, supporting the feasibility of TAVI in carefully selected bicuspid anatomies. AS: aortic stenosis; AV: aortic valve; TAVI: transcatheter aortic valve implantation (from reference [10]).

However, repeated blood transfusions remained associated with right ventricular dysfunction, emphasising the complex cardiovascular consequences of long-term haematological management.

Coronary artery disease remains a major focus of cardiovascular research. Coronary slow flow is an intriguing condition frequently associated with inflammation and microvascular dysfunction. Dai et al. reported that the total cholesterol-to-HDL cholesterol ratio was strongly associated with coronary slow flow and provided superior predictive value compared with total cholesterol alone [13]. These observations further support the use of integrated lipid indices in cardiovascular risk assessment.

Interventional cardiology continues to evolve through optimisation of procedural techniques. Eren et al. evaluated outcomes after T-stent and small protrusion (TAP) stenting in STEMI patients according to bifurcation angle [14]. Although overall results were favourable, patients with narrow bifurcation angles appeared to experience less favourable outcomes, highlighting the persistent importance of anatomical complexity in procedural planning.

Accurate prediction of long-term outcomes following percutaneous coronary intervention remains an important unmet need. Sotoudeheian developed the MORGAS score, a simple model incorporating age, fasting glucose, smoking status, and number of implanted stents [15]. Despite its simplicity, the score demonstrated encouraging predictive performance and may represent a useful tool for bedside risk assessment.

The search for improved coronary devices also continues. Abbas et al. performed a comprehensive meta-analysis comparing the Magmaris bioresorbable magnesium scaffold with contemporary drug-eluting stents [16]. While safety outcomes appeared reassuring, target lesion failure increased during longer-term follow-up, suggesting that the period of scaffold resorption may represent a vulnerable phase requiring further investigation.

Post-operative atrial fibrillation remains the most common arrhythmic complication after cardiac surgery. In a large systematic review and meta-analysis including more than 620,000 patients, Khalil et al. confirmed a strong association between post-operative atrial fibrillation and mortality, stroke, and acute kidney injury [17]. These findings reinforce the importance of prevention and early management strategies in surgical patients.

Several studies addressed specific cardiovascular populations that remain relatively understudied. Mustafa et al. analysed almost two million pregnancies and demonstrated that surrogate pregnancies were associated with higher rates of conduction abnormalities, gestational diabetes, and pre-eclampsia despite similar rates of major cardiovascular events [18]. As assisted reproductive technologies continue to expand worldwide, these findings underscore the need for dedicated cardiovascular surveillance.

Adults with congenital heart disease represent another rapidly growing patient population. Hoeben et al. demonstrated that HF remains a powerful determinant of adverse outcomes in adults with residual right-sided congenital heart disease [19]. Although re-interventions improved haemodynamic parameters, survival remained significantly impaired in patients with HF, highlighting the need for improved long-term management strategies. In Fontan patients, Tekerlek et al. showed that the oxygen uptake efficiency slope provides a robust assessment of exercise capacity and complements conventional functional evaluation, supporting its role in long-term risk stratification and follow-up [20].

Finally, Gao et al. evaluated thoracic endovascular aortic repair in patients with type B aortic dissection [21]. Acute intervention was associated with more favourable aortic remodelling and superior clinical outcomes compared with delayed treatment. These findings add to the growing body of evidence supporting earlier intervention in selected patients.

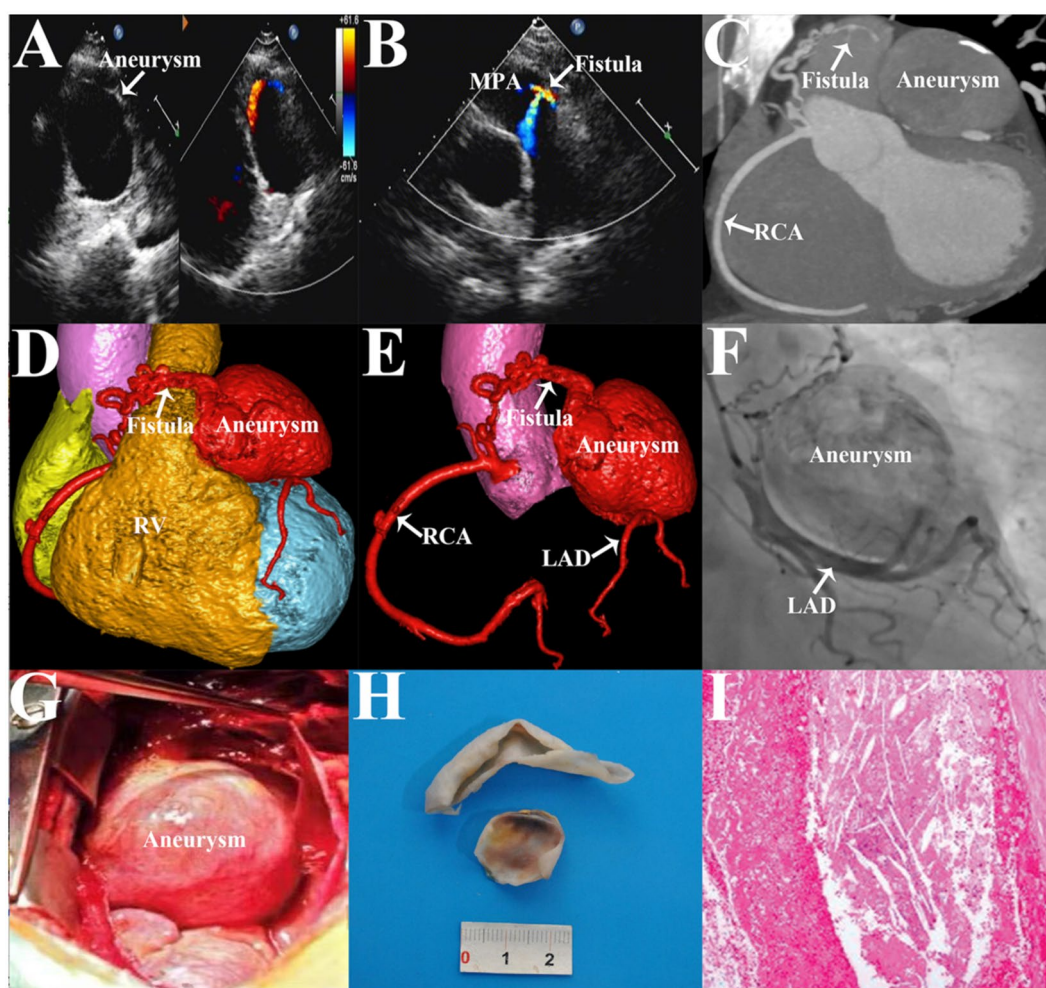


Figure 3. Multimodality imaging, surgical findings, and histopathology of a giant coronary artery aneurysm associated with a coronary artery–pulmonary artery fistula. Transthoracic echocardiography (A, B), coronary CT angiography (C–E), and coronary angiography (F) demonstrate a large aneurysm arising from a coronary artery–pulmonary artery fistula. Intraoperative (G) and macroscopic pathological findings (H) confirmed the diagnosis, while histological examination (I) revealed degenerative changes with thrombosis within the aneurysmal wall. LAD: left anterior descending artery; MPA: main pulmonary artery; RCA: right coronary artery; RV: right ventricle (from reference [23]).

Collectively, these studies highlight the growing shift towards personalised cardiovascular care through the integration of advanced imaging, biomarkers, haemodynamic assessment, digital technologies, and innovative interventions [22]. This issue also includes several educational focus images illustrating noteworthy cardiovascular cases (Figure 3) [23,24].

Disclosure statement

No potential conflict of interest was reported by the author(s).

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