HFA-PEFF score: prognosis in patients with preserved ejection fraction after transcatheter aortic valve implantation

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Abstract

Aims Many transcatheter aortic valve implantation (TAVI) candidates have underlying heart failure with preserved ejection fraction (HFpEF) in addition to symptomatic aortic stenosis. Diagnosis of HFpEF is challenging. The Heart Failure Association of the European Society of Cardiology proposed the HFA-PEFF score as part of a novel diagnostic algorithm. This study assessed the prognostic value of the HFA-PEFF score in patients with preserved ejection fraction after TAVI.

Methods and results This single-centre study included 570 consecutive TAVI patients with a preserved left ventricular ejection fraction of ≥ 50%. Patients with an HFA-PEFF score of ≥ 5 (n = 239 (41.9%)) were compared with those with <5 points (n = 331 (58.1%)). The primary outcome was a composite of all-cause mortality or first heart failure rehospitalization within 1 year after TAVI. Secondary endpoints were the individual components of the primary outcome. Patients with an HFA-PEFF score ≥ 5 had higher rates of comorbidities commonly associated with HFpEF, a higher rate of new pacemaker implantation after TAVI, were at increased risk of the primary composite endpoint (25.5% vs. 10.0%, P < 0.001), and rehospitalization for heart failure (11.7% vs. 3.9%, P < 0.001). Multivariable analysis confirmed an HFA-PEFF score ≥ 5 as an independent risk factor for the composite endpoint [hazard ratio 2.70, 95% confidence interval (CI) 1.70–4.28, P < 0.001] and for all-cause mortality (hazard ratio 2.58, 95% CI 1.46–4.53, P = 0.001).

Conclusion The HFA-PEFF score is associated with all-cause mortality and heart failure rehospitalization in patients with preserved ejection fraction after TAVI. This practical tool can easily be incorporated into risk stratification algorithms for TAVI patients.

Keywords Aortic stenosis; Transcatheter aortic valve implantation; Heart failure; Preserved ejection fraction; Mortality; Rehospitalization

Introduction

Aortic stenosis (AS) is the most frequent valvular heart disease in Europe and North America.1 The prevalence of AS increases with age and has been reported to be 3.4% for severe AS in the population aged > 75 years.2 AS leads to a gradual increase in pressure overload, thereby inducing a complex process of adaptive hypertrophic remodelling.3 Cardiac compensatory mechanisms initially maintain adequate wall stress, but later become maladaptive and translate
into structural damage in advanced stages of AS.\textsuperscript{4} Left ventricular diastolic dysfunction plays a pivotal role in the pathophysiology, as it occurs early in AS and worsens with disease progression.\textsuperscript{5} Transcatheter aortic valve implantation (TAVI) has been shown to potentially induce a process of reverse remodelling leading to structural and functional improvements.\textsuperscript{5,6}

A substantial proportion of TAVI patients may have underlying heart failure with preserved ejection fraction (HFpEF) in addition to AS, due to the fact that both entities share common risk factors, such as age, hypertension, diabetes and chronic kidney disease.\textsuperscript{7,8} Although mortality and heart failure hospitalization rates of patients with HFpEF are known to be high, the prognostic implications of HFpEF are not adequately reflected by current risk prediction models, such as the Society of Thoracic Surgeons score (STS) and guidelines for the management of patients undergoing TAVI.\textsuperscript{9–11} HFpEF is a complex clinical syndrome and its diagnosis remains challenging. In this context, the Heart Failure Association (HFA) of the European Society of Cardiology has proposed the HFA-PEFF score as part of a novel diagnostic algorithm in patients with suspected HFpEF.\textsuperscript{12}

The objective of this study was to assess the prognostic value of the HFA-PEFF score in patients with preserved ejection fraction after TAVI. The hypothesis was that the HFA-PEFF score identifies patients who are at elevated risk for adverse outcomes after TAVI.

**Methods**

**Study design**

A total of 1428 patients undergoing TAVI were prospectively enrolled in an observational study at the University Hospital Schleswig-Holstein, Kiel, Germany, between January 2014 and January 2020. All patients provided written informed consent. The study was approved by the Ethics Committee of the University of Kiel and conformed to the principles outlined in the Declaration of Helsinki. For the current study, consecutive TAVI patients with symptomatic AS and a preserved left ventricular ejection fraction (LVEF) of \( \geq 50\% \) were assessed for eligibility. LVEF was determined by standard transthoracic echocardiography using biplane images in all patients. Exclusion criteria were concomitant severe mitral or tricuspid regurgitation, non-transfemoral access, congenital bicuspid aortic valve, insufficient clinical or echocardiographic data, or inability to give consent. Outcomes were analysed by comparison between patients with an HFA-PEFF score \( \geq 5 \) and patients with an HFA-PEFF score \(< 5\).

The primary outcome was a composite of all-cause mortality or a first heart failure rehospitalization within 1 year after TAVI. The secondary endpoints were the individual components of the primary outcome. All-cause mortality, rather than cardiovascular mortality, was used as an endpoint, because (i) the correct classification of death in the TAVI population is challenging due to the high burden of comorbidities and (ii) a complete knowledge of medical details in deceased patients would be necessary for a correct classification, which can often not be obtained in this elderly patient population. The pre-specified follow-up period for this study was 1 year and was available for all patients.

**Procedural details**

The decision to perform TAVI was based on evaluation by the heart team and was in accordance with the European Society of Cardiology/European Association for Cardio-Thoracic Surgery guidelines for the management of valvular heart disease.\textsuperscript{9} All TAVI procedures were performed using either balloon-expandable SAPIEN3/SAPIEN3 Ultra (Edwards Lifesciences, Irvine, California, USA) or self-expanding CoreValve Evolut R/PRO (Medtronic, Minneapolis, Minnesota, USA) devices. The optimal type and size of transcatheter heart valve were determined using pre-procedural multidetector CT measurements and the 3mensio Structural Heart software (3mensio Medical Imaging BV, Bilthoven, The Netherlands).

**Data acquisition**

Patient characteristics, laboratory results, echocardiography data and medication were recorded. Follow-up was conducted by in-person visits to our cardiology outpatient clinic, direct phone calls or by contacting the patient’s general practitioner or cardiologist. Specific outcomes for TAVI adhered to the Valve Academic Research Consortium-3 (VARC-3) criteria.\textsuperscript{13} Rehospitalization for heart failure was diagnosed if a patient was hospitalized with typical symptoms and objective signs of worsening heart failure.

**HFA-PEFF score**

The HFA-PEFF score has previously been described in detail as part of the HFA-PEFF diagnostic algorithm for suspected HFpEF.\textsuperscript{12} In brief, the HFA-PEFF score comprises the three following domains: (i) functional, (ii) morphological and (iii) biomarker. Each domain has major and minor criteria and can contribute a maximum of 2 points. Thus, the highest HFA-PEFF score is 6. An HFA-PEFF score of \( \geq 5 \) is considered to be diagnostic of HFpEF.

For the calculation of the HFA-PEFF score, we used laboratory and echocardiography data at the time of discharge after the TAVI procedure. As explicitly stated in the consensus...
document, the HFA-PEFF score was designed as a practical tool that can be calculated even if not all parameters are available. Thus, we performed a stepwise HFA-PEFF score calculation process. For the functional domain we used average E/e' and pulmonary artery systolic pressure. The morphological domain was primarily based on the left ventricular mass index, as left atrial diameter rather than left atrial volume index (LAVI) was routinely stated in the echocardiography reports. If left ventricular mass index was <149/122 g/m² (the threshold for a major criterion in male/female patients) or ≤115/95 g/m² (the threshold for a minor criterion in male/female patients), LAVI was retrospectively measured in apical four-chamber and two-chamber views. For the biomarker domain, we used N-terminal pro-B-type natriuretic peptide (NT-proBNP) levels (pro BNP II, Roche Diagnostics, Mannheim, Germany). Global longitudinal strain data were not available.

Statistical analyses

Only patients with a full dataset and complete follow-up were included in the analysis. Baseline characteristics were summarized as means with standard deviation, medians with interquartile range, or counts with percentages. Intergroup comparisons were made using the Student's t-test, Mann–Whitney U test, χ² test or Fisher’s exact test, as appropriate. Rates of the primary and secondary outcomes during follow-up were assessed using Kaplan–Meier analyses and log-rank tests. For the Cox proportional hazards models, all variables that were significant in the univariable analysis (P value < 0.25) were used in a backward selection process based on the likelihood ratio criteria. Results were summarized as adjusted hazard ratios (HR) with 95% confidence intervals (CI). Continuous variables were dichotomized to keep the Cox model simple. For each variable, the proportional hazards assumption was confirmed by testing for interactions between Schoenfeld residuals and the log-transformed time. Statistical analyses were performed using R software, Version 4.0.4, and GraphPad PRISM, Version 8. A two-tailed P value < 0.05 was considered statistically significant.

Results

A total of 570 consecutive TAVI patients with preserved ejection fraction were eligible for the study. Based on echocardiography and laboratory data at discharge, 239 patients (41.9%) had an HFA-PEFF score ≥ 5, whereas 331 patients (58.1%) had an HFA-PEFF score < 5.

Patient characteristics and periprocedural outcomes

Baseline characteristics are presented in Table 1. Patients with an HFA-PEFF score ≥ 5 were significantly older and had a higher body mass index (BMI) than patients with an HFA-PEFF score < 5. In addition, the HFA-PEFF score ≥ 5 group had significantly higher rates of atrial fibrillation, diabetes, chronic obstructive pulmonary disease (COPD) and pulmonary hypertension. Patients with an HFA-PEFF score ≥ 5 also presented with worse renal function, a higher STS score and higher NT-proBNP levels at discharge. Moreover, LV mass and E/e' ratio were significantly higher. Severely dilated left atrium as well as moderate mitral and tricuspid regurgitation were also more prevalent in patients with a high HFA-PEFF score. Notably, there was no significant difference in terms of gender between the groups. The majority of patients (70.4%) had New York Heart Association class III or IV. Patients with an HFA-PEFF score ≥ 5 showed higher rates of New York Heart Association class III/IV at baseline compared with patients with an HFA-PEFF score < 5 (P < 0.001).

Medication at discharge and data on procedural outcomes are summarized in Table 2. Beta-blockers and diuretics were more frequently prescribed in patients with an HFA-PEFF score ≥ 5. New permanent pacemaker implantation was the only VARP-3-related outcome that was more often observed in patients with a high HFA-PEFF score.

Primary and secondary study outcomes

All-cause mortality or heart failure rehospitalization within 1 year after TAVI (the primary endpoint) occurred in 61 patients (25.5%) in the HFA-PEFF score ≥ 5 group compared with 33 patients (10.0%) in the HFA-PEFF score < 5 group (P < 0.001) (Figure 1A). A total of 40 deaths (16.7%) in patients with an HFA-PEFF score ≥ 5 were observed, which is a significantly higher all-cause mortality rate compared with 20 deaths (6.0%) among patients with an HFA-PEFF score < 5 (P < 0.001) (Figure 1B). Based on available patient records, confirmed non-cardiovascular death occurred in nine patients (15%) of the total study population. Causes of non-cardiovascular death included infectious disease/septic shock (five patients), advanced pulmonary disease (two patients), malignancy (one patient) and gastrointestinal bleeding (one patient). In addition, heart failure rehospitalization was reported in 28 patients (11.7%) in the HFA-PEFF score ≥ 5 group as opposed to 13 patients (3.9%) in the HFA-PEFF score < 5 group (P < 0.001).

The results of univariable and multivariable Cox regression analyses are presented in Tables 3 and 4. Ten variables were found to be significantly associated with the primary composite outcome of all-cause mortality or heart failure rehospital-
ization in the univariable analysis (P < 0.25, respectively). Of these, five parameters were included in the final multivariable analysis. An HFA-PEFF score ≥ 5 was confirmed as the most significant risk factor for the primary composite endpoint (HR 2.70, 95% CI 1.70–4.28, P < 0.001) (Table 3). Other significant risk factors included BMI > 26.4 kg/m² (HR 0.63, 95% CI 0.42–0.95, P = 0.029), male gender (HR 1.70, 95% CI 1.13–2.55, P = 0.011) and COPD (HR 1.77, 95% CI 1.07–2.92, P = 0.027) (Table 3). In addition, an HFA-PEFF score ≥ 5 was determined as a significant risk factor for all-cause mortality (HR 2.58, 95% CI 1.46–4.53, P = 0.001) after adjustment for BMI, male sex, moderate tricuspid regurgitation, STS score ≥ 4%, and COPD (Table 4).

### Discussion

The main finding of this study was that the HFA-PEFF score is significantly associated with all-cause mortality and heart failure rehospitalization in patients with preserved ejection fraction after TAVI. This is the first report on the potential role of the HFA-PEFF score in the context of TAVI.

Most patients referred for TAVI have a preserved ejection fraction, including those who have underlying HFpEF in addition to symptomatic AS. The prognostic implications of HFpEF are currently not accounted for in clinical practice or by risk scores. Patients with HFpEF have a lower risk of mortality and a composite of death and heart failure rehospitalization...
Table 2  Procedural variables, medication at discharge and outcomes

|                                      | Total (n = 570) | HFA-PEFF score ≥ 5 (n = 239) | HFA-PEFF score < 5 (n = 331) | P value |
|--------------------------------------|-----------------|------------------------------|-----------------------------|---------|
| Valve type, n (%)                    |                 |                              |                             |         |
| Self-expanding valve                 | 310 (54.4)      | 134 (56.1)                   | 176 (53.2)                  | 0.494   |
| Balloon-expandable valve             | 260 (45.6)      | 105 (43.9)                   | 155 (46.8)                  |         |
| Procedural duration (min)            | 48 (40–60)      | 49 (40–68)                   | 48 (39–58)                  | 0.065   |
| Contrast medium (mL)                 | 84 (68–103)     | 83 (65–100)                  | 85 (70–105)                 | 0.389   |
| Medication at discharge, n (%)       |                 |                              |                             |         |
| ACE-I/ARB                            | 461 (80.9)      | 195 (81.6)                   | 266 (80.4)                  | 0.713   |
| β-Blocker                            | 402 (70.5)      | 188 (78.7)                   | 214 (64.7)                  | <0.001  |
| MRA                                  | 48 (8.4)        | 22 (9.2)                     | 26 (7.9)                    | 0.567   |
| Diuretics                            | 385 (67.5)      | 187 (81.2)                   | 198 (59.8)                  | <0.001  |
| Loop diuretics                       | 353 (61.9)      | 168 (70.3)                   | 185 (55.9)                  | 0.003   |
| Dihydropyridine CCBs                 | 197 (34.6)      | 75 (31.4)                    | 122 (36.9)                  | 0.175   |
| VARC-3, n (%)                        |                 |                              |                             |         |
| Myocardial infarction                | 2 (0.4)         | 2 (0.8)                      | 0 (0)                       |         |
| Stroke with disability               | 4 (0.7)         | 1 (0.4)                      | 3 (0.9)                     | 0.643   |
| AKIN stage 3/4                       | 5 (0.9)         | 2 (0.8)                      | 3 (0.9)                     | >0.999  |
| Conversion to open surgery           | 0 (0)           | 0 (0)                        | 0 (0)                       |         |
| New permanent pacemaker              | 80 (14.0)       | 54 (22.6)                    | 26 (7.9)                    | <0.001  |
| Type 3 (life-threatening) bleeding   | 18 (3.2)        | 4 (1.7)                      | 14 (4.2)                    | 0.095   |
| Study endpoints, n (%)               |                 |                              |                             |         |
| Primary composite outcome            | 94 (16.5)       | 61 (25.5)                    | 33 (10.0)                   | <0.001  |
| All-cause mortality                  | 60 (10.5)       | 40 (16.7)                    | 20 (6.0)                    | <0.001  |
| Heart failure rehospitalization      | 41 (7.2)        | 28 (11.7)                    | 13 (3.9)                    | <0.001  |

AKIN, Acute Kidney Injury Network; ACE-I, angiotensin-converting enzyme inhibitor; ARB, angiotensin receptor blocker; CCB, calcium channel blocker; MRA, mineralocorticoid receptor antagonist; pEF, preserved ejection fraction with no heart failure; VARC-3, Valve Academic Research Consortium 3.

Values are presented as counts (percentages) or median (interquartile range).

Figure 1  Kaplan–Meier analyses for the primary composite endpoint (A) and the secondary endpoints of all-cause mortality (B) and heart failure rehospitalization (C).
Table 3 Univariable and multivariable analyses for the composite of all-cause mortality or heart failure rehospitalization after TAVI

| Variable                                      | Univariable analysis | Multivariable analysis |
|-----------------------------------------------|----------------------|------------------------|
| HFA-PEFF score ≥ 5                           | HR (95% CI)          | P value                |
| BMI ≥ 26.4 kg/m²                              | 2.80 (1.83–4.28)     | <0.001                 |
| Male gender                                   | 1.60 (1.07–2.40)     | 0.022                  |
| Atrial fibrillation                           | 1.72 (1.15–2.58)     | 0.009                  |
| Severe PHT (PASP > 55 mmHg)                   | 2.82 (1.74–4.59)     | <0.001                 |
| Moderate TR                                   | 1.92 (1.09–3.38)     | 0.025                  |
| STS score ≥ 4%                                | 1.47 (0.98–2.22)     | 0.062                  |
| COPD                                         | 2.15 (1.32–3.50)     | 0.002                  |
| eGFR < 60 mL/min/1.73 cm²                     | 1.49 (0.95–2.33)     | 0.081                  |
| NYHA class III/IV at baseline                 | 1.34 (0.83–2.14)     | 0.230                  |
| BMI, body mass index; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; eGFR, estimated glomerular filtration rate; NYHA, New York Heart Association; PASP, pulmonary artery systolic pressure; PHT, pulmonary hypertension; STS, Society of Thoracic Surgeons; TAVI, transcatheter aortic valve implantation; TR, tricuspid regurgitation. Results are presented as adjusted hazard ratios (HR) with 95% confidence intervals (CI).

Table 4 Univariable and multivariable analyses for all-cause mortality after TAVI

| Variable                                      | Univariable analysis | Multivariable analysis |
|-----------------------------------------------|----------------------|------------------------|
| HFA-PEFF score ≥ 5                           | HR (95% CI)          | P value                |
| Age > 82.1 years                              | 1.50 (0.91–2.55)     | 0.110                  |
| BMI ≥ 26.4 kg/m²                              | 0.72 (0.43–1.20)     | 0.210                  |
| Male gender                                   | 1.73 (1.04–2.87)     | 0.035                  |
| Atrial fibrillation                           | 1.97 (1.19–3.27)     | 0.009                  |
| Severe PHT (PASP > 55 mmHg)                   | 2.88 (1.58–5.24)     | <0.001                 |
| Moderate TR                                   | 2.43 (1.26–4.67)     | 0.008                  |
| STS score ≥ 4%                                | 2.13 (1.25–3.62)     | 0.005                  |
| COPD                                         | 2.69 (1.52–4.77)     | <0.001                 |
| eGFR < 60 mL/min/1.73 cm²                     | 1.64 (0.92–2.90)     | 0.092                  |
| CAD                                          | 1.46 (0.88–2.42)     | 0.140                  |
| BMI, body mass index; CAD, coronary artery disease; COPD, chronic obstructive pulmonary disease; eGFR, estimated glomerular filtration rate; PASP, pulmonary artery systolic pressure; PHT, pulmonary hypertension; STS, Society of Thoracic Surgeons; TAVI, transcatheter aortic valve implantation; TR, tricuspid regurgitation. Results are presented as adjusted hazard ratios (HR) with 95% confidence intervals (CI).

compared with patients with a reduced ejection fraction; however, the risk remains substantial. It has been recommended that the diagnosis of HfPEF should be based on assessment of a combination of echocardiographic measurements of cardiac structure and function, and NT-proBNP levels. The HFA-PEFF diagnostic algorithm provides a score based on these three domains, which can be calculated using various criteria within each domain, making it practical for use in a routine clinical setting.

Several studies have confirmed that the HFA-PEFF score is a reliable diagnostic tool for identifying HfPEF. Is has demonstrated prognostic value for clinical outcomes in patients hospitalized with decompenated HfPEF and in patients with unexplained dyspnea who have a score above the diagnostic threshold. Conversely, Abramov and Parwani have commented that the prognostic implications of scores, such as the HFE-PEFF score, might be due to the patient’s comorbidity burden rather than a result of a particular cardiac pathology. As a consequence, optimal treatment of the comorbidities such as hypertension, diabetes and pulmonary disease is crucial. In addition, the HFA-PEFF score may also be influenced by parameters other than HfPEF. As an example, E/e’ ratio and NT-proBNP concentrations can be modulated by chronic kidney disease, thus increasing the HFA-PEFF score. This needs to be taken into consideration when using these parameters.

We hypothesized that the HFA-PEFF score would identify patients who were at increased risk of adverse outcomes after TAVI. We found that patients with an HFA-PEFF score ≥ 5 had a significantly increased risk of death, rehospitalization for heart failure, and the composite of both outcomes, compared with patients with an HFA-PEFF score < 5. Multivariable analysis confirmed an HFA-PEFF score ≥ 5 as an independent risk factor for the composite endpoint and for
Prognostic implications of HFA-PEFF score

1077

all-cause mortality. Other significant factors in our study included lower BMI, male gender, severe pulmonary hypertension and COPD, which have been previously reported as predictors of poor outcomes after TAVI.22

To the best of our knowledge, this is the first report on the prognostic value of the HFA-PEFF score in patients with AS and preserved ejection fraction treated with TAVI. A recent study found that the H2FPEF score, another score that has been developed to facilitate the diagnosis of HFrEF, was an independent predictor of all-cause mortality and a composite of cardiovascular mortality or heart failure rehospitalization in patients with preserved ejection fraction undergoing TAVI.23 The H2FPEF score is based on evaluation of clinical and echocardiographic characteristics, whereas the HFA-PEFF score includes echocardiographic morphological and functional parameters and a biomarker.12,24

In contrast to the aforementioned study, the parameters for the calculation of the HFA-PEFF score in our analysis were obtained after TAVI, that is, after the correction of AS. In our study, we found that the HFA-PEFF score identified TAVI patients with common comorbidities associated with HFrEF, such as diabetes, COPD and pulmonary hypertension. This was also observed in the study using the H2FPEF score in TAVI patients.23 It should be noted that the HFA-PEFF score in our study was presumably still influenced by the haemodynamic effects caused by long-standing AS. Based on our study design, caution should thus be exercised when making a definitive diagnosis of HFrEF in our patient cohort despite the fact that the patient characteristics are highly indicative of HFrEF. However, as stated in the consensus paper on the diagnosis of HFrEF, significant valvular heart disease must be excluded before diagnosing HFrEF.12 Future studies should therefore investigate the value of the HFA-PEFF score obtained during further follow-up after TAVI. With respect to VARC-3 outcomes after TAVI, we found a higher rate of new permanent pacemaker implantation in patients with an HFA-PEFF score ≥5, while there was no statistically significant difference in the use of balloon-expandable vs. self-expandable prostheses. In our opinion, this finding is likely to reflect an advanced stage of adverse cardiac remodelling including a more vulnerable conduction system in patients with an HFA-PEFF score ≥5. A difference in pacemaker implantations was not noted between patients with high vs. low scores in the study investigating the H2FPEF score.23

Patients with HFrEF have a worse prognosis than those without heart failure, and patients in the advanced stages of AS and HFrEF have been reported to be at increased risk. Some studies have found that among TAVI patients with severe AS, in-hospital mortality rates were similar in those with HFrEF and those with heart failure with a reduced ejection fraction, while others have found a better prognosis at 1 year in those with HFrEF compared with those with reduced ejection fraction.25,26 Notably, in patients with HFrEF, treating moderate AS may be beneficial, due to the fact that AS is a modifiable driver of diastolic dysfunction. AS causes increased left ventricular afterload, which leads to left ventricular hypertrophy and results in diastolic dysfunction.27 Diastolic dysfunction develops early in the course of AS and worsens as the disease progresses.3 TAVI can potentially induce reverse remodelling, which can lead to structural and functional improvements.5,6 Treating patients earlier in the AS disease course may help limit diastolic dysfunction and potentially reduce the negative impact of HFrEF. Valvular heart disease, such as AS, may mimic HFrEF, making the diagnosis of HFrEF particularly challenging in this context. While TAVI leads to a successful resolution of AS, the HFA-PEFF score may be helpful for risk stratification after the procedure. In the recently published EMPEROR-preserved study, empagliflozin reduced the combined risk of cardiovascular death or heart failure rehospitalization in patients with HFrEF (defined as an LVEF ≥40%), regardless of their diabetes status.28 As a consequence, the HFA-PEFF score may also be useful for identifying TAVI patients with HFrEF who may benefit from specific treatment in addition to the TAVI procedure, including the use of empagliflozin.

Limitations

Several limitations of the study should be acknowledged. First, our study is limited by its single-centre design. Second, echocardiography data were obtained and evaluated by several examiners resulting in measurement variability. In this context, global longitudinal strain data (a minor criterion in the functional domain of the HFA-PEFF score) were not available. Left atrial diameter rather than LAVI was routinely reported in most patients. Third, reassessment of the HFA-PEFF score as well as advanced HFrEF workup (as suggested by the HFA consensus document) during follow-up, which may have resulted in better classification of patients, was not performed. Fourth, follow-up data to evaluate reverse remodelling, physical capacity and quality of life were not sufficiently available. Despite these limitations, our study demonstrates for the first time that the HFA-PEFF score may aid in improving risk stratification of AS patients treated with TAVI.

Conclusion

The HFA-PEFF score is associated with all-cause mortality and heart failure rehospitalization in patients with preserved ejection fraction after TAVI. The HFA-PEFF score is a practical tool that can easily be incorporated into risk stratification algorithms for patients after TAVI.
Conflict of interest

G. Lutter is a consultant for Edwards Lifesciences, Medtronic, Boston Scientific and Abbott. D. Frank is a consultant for Edwards Lifesciences and Medtronic and has received research funding from Edwards Lifesciences. P. Bramlage has received research funding from Edwards Lifesciences. All other authors have no commercial or financial relationships that could be construed as a potential conflict of interest.

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