



Early Diastolic Strain Rate in Relation to Systolic and Diastolic Function and Prognosis in Aortic Stenosis

Jordi S. Dahl, MD, PhD,^a Sergio Barros-Gomes, MD,^b Lars Videbæk, MD, PhD,^a Mikael K. Poulsen, MD, PhD,^a Issa F. Issa, MD,^a Rasmus Carter-Storch, MD,^a Nicolaj Lyhne Christensen, MD,^a Anja Kumme, MD, DMSci,^a Patricia A. Pellikka, MD,^b Jacob E. Møller, MD, PhD, DMSci^a

ABSTRACT

OBJECTIVES This study examined the impact of early mitral inflow velocity-to-early diastolic strain rate (E/SRe) ratio on long-term outcome after aortic valve replacement (AVR) in aortic stenosis (AS).

BACKGROUND In AS, increased filling pressures are associated with a poor prognosis and can be estimated using the early diastolic mitral inflow velocity-to-early diastolic velocity of the mitral annulus (E/e') ratio. Recent studies suggest that the E/SRe ratio surpasses the E/e' ratio in estimating outcome.

METHODS Pre-operative evaluation was performed in 121 patients with severe AS (aortic valve area <1 cm²) and left ventricular ejection fraction (LVEF) of >40% who were scheduled for AVR. Patients were divided according to E/SRe median and followed for 5 years. The primary endpoint was overall mortality.

RESULTS LVEF was lower (53 ± 7% vs. 56 ± 7%, respectively; p = 0.03) and a restrictive filling pattern more common (28% vs. 8%, respectively, p = 0.005) in patients with increased E/SRe ratio. Five-year overall mortality was increased in patients with high E/SRe (40% vs. 15%, respectively; p = 0.007). In univariate Cox regression analysis, E/SRe, age, European System for Cardiac Operative Risk Evaluation (EuroSCORE), LV mass index, left atrial volume index, LVEF, global longitudinal strain, E/e' ratio, and N-terminal pro-B-type natriuretic peptide level were univariate predictors of overall mortality, although when we adjusted for the predefined variables age, history of diabetes mellitus and LVEF, only E/SRe and left atrial volume index remained associated with overall mortality. Even when we included left atrial volume index in the multivariate model, E/SRe was significantly associated with overall mortality (hazard ratio [HR]: 2.2; 95% confidence interval [CI]: 1.1 to 4.4; p < 0.05); additionally, in a model with forward selection, E/SRe was the sole predictor (HR: 2.9; 95% CI: 1.6 to 5.5; p = 0.001). The overall log likelihood chi-square analysis of the predictive power of the multivariate model containing E/SRe was statistically superior to models based on the E/e' ratio.

CONCLUSIONS Pre-operative E/SRe ratio was significantly associated with long-term post-operative survival and was superior to the E/e' ratio in patients with severe AS undergoing AVR. (Effect of Angiotensin II Receptor Blockers (ARB) on Left Ventricular Reverse Remodelling After Aortic Valve Replacement in Severe Valvular Aortic Stenosis; [NCT00294775](https://doi.org/10.1016/j.jcmg.2015.06.029)) (J Am Coll Cardiol Img 2016;9:519-28) © 2016 by the American College of Cardiology Foundation.

Aortic stenosis (AS) is characterized by left ventricular (LV) pressure overload leading to LV hypertrophy and fibrosis. The consequence is increased chamber stiffness and delayed active LV relaxation, which will cause LV diastolic

dysfunction, increased filling pressure, and worsening prognosis (1-3). A cornerstone in assessing diastolic function and estimating filling pressure noninvasively is assessment of the early diastolic mitral inflow velocity-to-early diastolic velocity of

From the ^aDepartment of Cardiology, Odense University Hospital, Odense, Denmark; and the ^bDivision of Cardiovascular Diseases, Mayo Clinic, Rochester, Minnesota. This study was funded by the Danish Heart Foundation, the Family Hede Nielsen's Fund, the Augustinus Fund, and the Brødrene Hartmanns Fund. The authors have reported that they have no relationships relevant to the contents of this paper to disclose.

**ABBREVIATIONS
AND ACRONYMS**

- AS** = aortic stenosis
- AUC** = area under the curve
- AVR** = aortic valve replacement
- GLS** = global longitudinal strain
- LA** = left atrial
- LV** = left ventricular
- LVEF** = left ventricular ejection fraction
- NT-proBNP** = N-terminal pro-B-type natriuretic peptide
- SRe** = early diastolic strain rate

the mitral annulus (E/e') ratio (3,4). Recent studies, however, have raised some important concerns about the E/e' ratio (4-6), some of which are related to angle dependency and the effect of passive tethering of e' .

Measurement of the early mitral inflow velocity-to-early diastolic strain rate (E/SRe) ratio has recently been proposed as a novel marker of elevated LV filling pressure (7,8). The potential advantage of this marker is that the regional early velocity of diastolic deformation (strain rate) more accurately reflects diastolic performance of all myocardial segments. Moreover, based on 2-dimensional (2D) speckle tracking echocardiography, diastolic deformation is less depending on insonation angle. In a recent paper, the E/SRe ratio

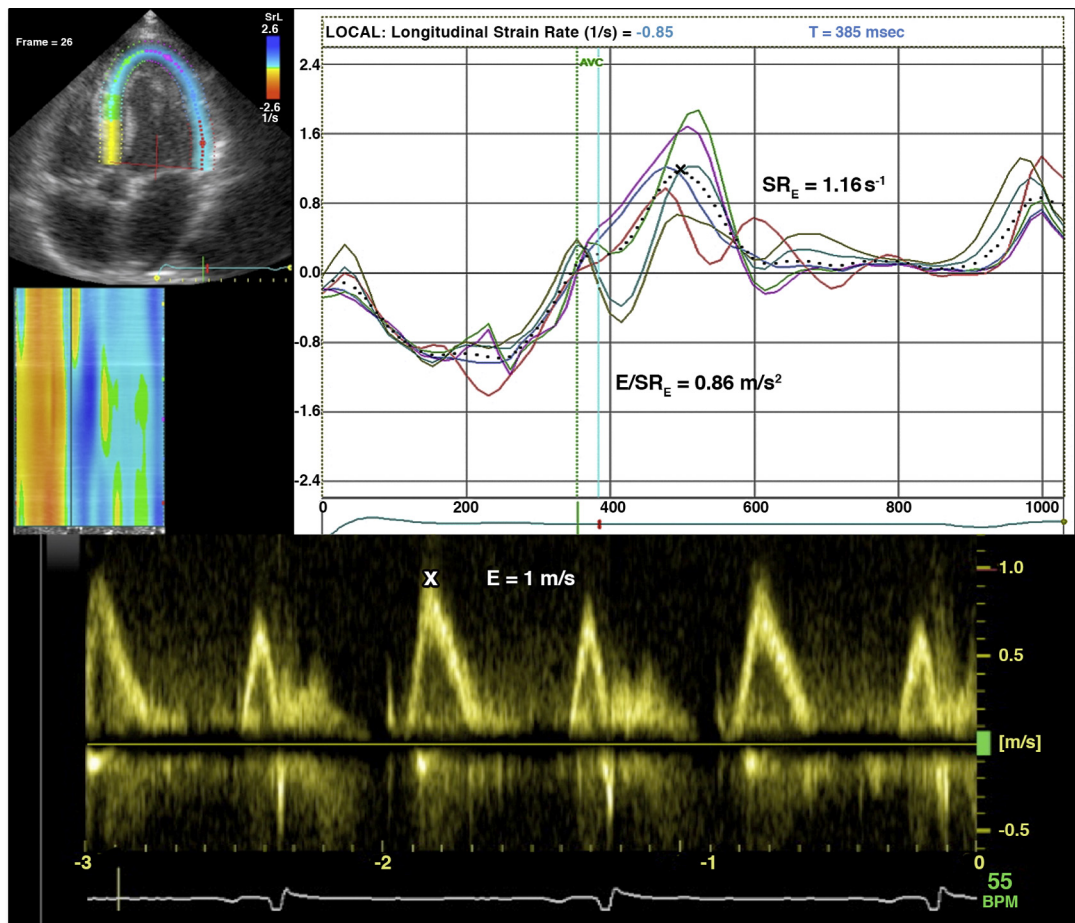
was superior to E/e' in predicting cardiovascular events among patients with myocardial infarction (9). Whether this also is the case among patients with AS is not known. We thus hypothesized that E/SRe would be associated with adverse outcome after aortic valve replacement (AVR) among patients with severe symptomatic AS and that the E/SRe ratio would provide incremental information to E/e' .

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METHODS

The present investigation was a post-hoc analysis of a prospective, single-center, randomized study conducted to evaluate the effect of candesartan in addition to conventional treatment on reverse remodelling in consecutive patients undergoing AVR

FIGURE 1 Example of Measurement of E/SRe



Measurements are shown of early mitral inflow velocity (E) using pulse-wave Doppler and early diastolic strain rate (SRe) from 2D speckle tracking. AVC = aortic valve closure.

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