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The Role of Vortex Flow Analysis by Contrast Echocardiography to Predict Clinical Outcome in Heart Failure with Reduced Ejection Fraction

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Abstract

Aims: The aim of this study was to evaluate the role of vortex flow analysis by contrast echocardiography (CE) to predict adverse clinical outcomes in patients with heart failure (HF) with reduced ejection fraction (HFrEF).

Methods: Between January 2019 and August 2021, patients with HFrEF (ejection fraction < 50%) who underwent vortex echocardiography and NT-proBNP simultaneously were enrolled. Vortex flow parameters were evaluated. Patients were compared according to the presence and absence of major adverse cardiac events (MACE; a composite of urgent hospital visits due to HF aggravation, HF admission, heart transplantation, left ventricular assist device implantation, and cardiovascular death).

Results: A total of 100 patients (age 62.7 ± 15.1 , male 65%) were. Across a median follow-up of 212 days, 32 patients (32%) experienced MACE. Among vortex parameters, patients with MACE had higher vortex depth (0.41 ± 0.07 vs. 0.35 ± 0.08 , $p=0.000$), lower vorticity fluctuation (VF, 0.68 ± 0.17 vs. 0.78 ± 0.13 , $p=0.004$) and lower kinetic energy fluctuation (KEF, 1.04 ± 0.44 vs. 1.35 ± 0.43 , $p=0.001$). In multivariate analysis, high NT-proBNP, low EF, low KEF, low VF, high LAVI, ICD implantation, posterior wall thickness, and A velocity were independent predictors for MACE. The combination of KEF and NT-proBNP showed the highest area under the curve compared to the conventional parameters.

Conclusions: Quantitative LV vortex flow parameter KEF was useful in predicting adverse events in HFrEF patients. Adding KEF to the previous biomarker NT-proBNP enhanced the prediction of clinical outcomes.