Frailty among Older Adults with Heart Failure: Implications of Heart Rate Dynamic Assessment

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Although extensive achievements have been occurred in the treatment of patients with heart failure (HF), the morbidity, mortality, and economic burden remain high. In this regard, the American College of Cardiology has advised that more research is urgently needed for risk stratification of HF patients, especially those who are developing frailty secondary to HF. Frailty affects one in every two patients with HF, a prevalence that is six times larger than what is established among community-dwelling older adults. Despite the importance of frailty assessment, no gold standard exists for HF patients. Most commonly implemented frailty assessment tools, include Fried phenotype (5 scale criteria), the multidimensional Edmonton frailty score (EFS), and the Deficit Index (DI) based on the accumulation of deficits. Nevertheless, frailty assessments, such as Fried frailty phenotype or Rockwood deficit index are long to perform, either in part or fully subjective, require trained clinical staff to perform or interpret the assessment, or require a walking test for physical assessment. We developed and validated a novel multimodal HF frailty meter for the risk stratification of HF patients. Within our approach, we will promote heart rate (HR) dynamics (i.e., HR response to physical activity) as a more robust and direct measure of lack of physiological reserve due to frailty compared to resting-state measures of HR variability (HRV). For physical activity, our approach incorporates a novel upper-extremity function (UEF) test, which is feasible for HF older adults, especially those with mobility disorder and lack of strength to perform traditional cardiopulmonary exercise or 6-minute walk testing. This UEF task includes a fast 20-second elbow flexion while the motor and HR functions are measured using wearable sensors. Using this test, incorporating both HR dynamics and the UEF kinematics parameters, we were able to predict frailty with a sensitivity of 82% and specificity of 83%.