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## Cluster analysis and prediction of clinical outcomes for CHF

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Chronic heart failure (CHF) is a syndrome rather than a specific disease. However current classifications rely on subjective measures of NYHA (I-IV), LVEF (preserved or reduced), or stages (A to D), whereas the increasing recognition that these criteria may not adequately represent disease heterogeneity. We have constructed an observational and prospective study. A cluster analysis was performed using a patient's clinical features, including age, sex, body surface area, blood pressure, heart rates, smoking and drinking, NYHA, HF etiology, comorbidities, symptoms, biomarker levels, eGFR, echocardiography scores, complete blood count, and blood chemistries. Kaplan-Meier survival analysis was performed to determine hospitalization and mortality risks corresponding to each cluster. Data was available on 249 patients which were categorized into three clusters. The labels for the three clusters were: aggravated clinical signs (cluster 1) and worsening cardiac function (cluster 2) and renal function impairment (cluster 3). Kaplan-Meier survival analysis and log-rank testing were utilized to compare clinical outcomes between three clusters. The six months readmission and mortality were 38.5% (cluster 1), 27.6% (cluster 2), 66.7% (cluster 3). The clusters showed statistically significant differences in terms of six months hospitalization and mortality rates (log-rank  $\chi^2=17.336$ ,  $p<0.05$ ). Finally, cluster analysis identified three clusters in CHF and each cluster corresponded to a different clinical outcomes. Our analysis suggests that comprehensive assessment of signs and symptom, cardiac and renal function, may yield clinical outcomes in more consistent groups.