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A higher ultrafiltration rate is associated with worsening of the echocardiographic left atrial volume index in incident hemodialysis patients

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Background: Optimal fluid management is crucial in the management of dialysis patient. However, too rapid fluid removal and the resultant higher ultrafiltration rate (UFR) disadvantageously promote hemodynamic instability and maladaptive cardiac structural changes. This study evaluated the effects of the rapid UFR on the changes of echocardiographic left atrial volume index (LAVI) over period.

Methods: A longitudinal observational study enrolled 124 new hemodialysis patients. Echocardiography was performed at baseline and repeated 19.7 (11.3-23.1) months apart. The changes in LAVI (Δ LAVI/yr, mL/m^{2.7}/year) were calculated, and the 75th percentile of the Δ LAVI/yr distribution was regarded as a “pathological” increment. The UFR was expressed in mL/h/kg, and we employed a mean UFR over 30 days (approximately 12~13 treatments).

Results: The mean inter-dialytic weight gain was 1.88 ± 0.94 kg, and the UFR were 8.01 ± 3.87 mL/h/kg. The baseline and follow-up LAVI were 48.0 ± 19.4 and 48.1 ± 19.2 mL/1.73m², respectively. The pathological increment in Δ LAVI/yr was 4.87 mL/1.73m²/yr. Correlation analysis showed that Δ LAVI/yr was closely related to the baseline blood pressure (BP), hemoglobin level, residual renal function, and UFR. According to the receiver operating characteristics curve, the best cut-off of value of UFR for the predicting the pathological increment was 10 mL/h/kg, with the area under the curve of 0.712. In multivariate analysis, systolic BP, a history of coronary artery disease, hemoglobin < 10 g/dL, and high UFR were significant predictors. An increase of 1 mL/h/kg in the UFR was associated with a 22% higher risk of a worsening of the LAVI (odds ratio, 1.22; 95% confidence interval, 1.05-1.41; p= 0.009).

Conclusion: For patient starting hemodialysis, a rapid UFR over 10 mL/h/kg may be associated with maladaptive worsening of the LAVI, a strong predictor of long-term adverse outcomes.

Keywords: hemodialysis, left atrial volume index, mortality, ultrafiltration rate