Red cell distribution width (RDW) to serum albumin ratio (RAR) in chronic heart failure


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Background: The RDW to albumin ratio (RAR) is a novel and simple biomarker of inflammation. The value of RAR in predicting acute HF prognosis has been suggested. However, its application in chronic HF was never investigated.

Purpose: To study the association of RAR with all-cause mortality in chronic HF.

Methods: We conducted a retrospective cohort study in patients followed in a HF clinic of a tertiary care academic hospital between January 2012 and December 2020. Consecutive adult patients with left ventricular systolic dysfunction (ejection fraction <50%) referred to the clinic were included. Patients with no measurement of RDW and no measurement of serum albumin were excluded from the analysis. The RAR was calculated as RDW (in %) / albumin (in g/dL). Patients were followed up to December 2022 and the endpoint under analysis was all-cause mortality. The association of RAR with mortality was assessed using a Cox-regression analysis. RAR was analysed as a continuous variable and as a categorical variable (cut-off 1st tertile). Multivariable models were built with adjustments to age, sex, arterial hypertension (AHT) history, diabetes mellitus (DM), atrial fibrillation (AF), ischaemic HF, severe left ventricular systolic dysfunction (LVSD), New York Heart Association class, systolic blood pressure (SBP), estimated glomerular filtration rate, haemoglobin, BNP, beta blocker (BB) use, angiotensin converting enzyme inhibitors or angiotensin receptor blockers (ACEi), angiotensin receptor neprilysin inhibitors (ARB) use and mineralocorticoid receptor antagonist (MRA) use.

Results: We studied 754 patients, 63.3% male, mean age 71 (13) years, 64.1% had AHT history, 38.5% had DM, 33.3% had AF, HF was ischaemic in 44.4%, and 49.3% has severe LVSD. A total of 92.3% of the patients were on BB, 82.8% on ACEi or ARB or ARNi, and 29.7% on MRA. RAR presented a skewed right tailed distribution with a median value of 3.56, percentile 33.3 = 3.31 and percentile 66.7 = 3.85. During a median follow-up of 43 months 370 (49.1%) patients died. Mortality increased with increasing RAR: 33.2% in patients with ratio <3.31, 50.6% in patients with ratio 3.31 to <3.85 and 63.1% in patients with ratio ≥3.85, p<0.001. The multivariate adjusted HR of all-cause death was 1.27 (95% CI: 1.12-1.43) per each unit increase in the RDW: albumin ratio. If RAR was analysed as a categorical variable, patients with RAR ≥3.31 (1st tertile) presented an increased mortality risk of 1.48 (1.12-1.96); the increase in risk was independent of age, sex, comorbidities, LVSD, symptoms, SBP, haemoglobin, renal function, BNP and disease-modifying therapy.

Conclusions: The RAR is a strong and independent mortality predictor in chronic HF. Patients with a RAR ≥3.31 have a 48% increase in all cause-death in the long term; the increase in risk is of 27% per each unit rise in the ratio. Our results reinforce the importance of inflammation in chronic HF pathophysiology and progression.