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# Vitamin D status and outcomes in heart failure patients

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## Abstract

**Aims** Vitamin D status has been implicated in the pathophysiology of heart failure (HF). The aims of this study were to determine whether a low vitamin D status is associated with prognosis in HF and whether activation of the renin–angiotensin system (RAS) and inflammatory markers could explain this potential association.

**Methods and results** We measured 25-hydroxy-vitamin D (25(OH)D), plasma renin activity (PRA), interleukin-6 (IL-6), C-reactive protein (CRP), and the incidence of death or HF rehospitalization in 548 patients with HF. Median age was 74 (64–80) years, left ventricular ejection fraction was 30% (23–42), and mean follow-up was 18 months. Low 25(OH)D levels were associated with female gender ($P< 0.001$), higher age ($P= 0.002$), and higher N-terminal pro-brain natriuretic peptide (NT-proBNP) levels ($P< 0.001$). Multivariable linear regression analysis showed that PRA ($P= 0.048$), and CRP levels ($P= 0.006$) were independent predictors of 25(OH)D levels. During follow-up, 155 patients died and 142 patients were rehospitalized. Kaplan–Meier analysis showed that lower 25(OH)D concentration was associated with an increased risk for the combined endpoint (all-cause mortality and HF rehospitalization; log rank test $P= 0.045$) and increased risk for all-cause mortality (log rank test $P= 0.014$). After adjustment in a multivariable Cox regression analysis, low 25(OH)D concentration remained independently associated with an increased risk for the combined endpoint [hazard ratio (HR) 1.09 per 10 nmol/L decrease; 95% confidence interval (CI) 1.00–1.16; $P= 0.040$] and all-cause mortality (HR 1.10 per 10 nmol/L decrease; 95% CI 1.00–1.22; $P= 0.049$).

**Conclusion** A low 25(OH)D concentration is associated with a poor prognosis in HF patients. Activation of the RAS and inflammation may confer the adverse effects of low vitamin D levels.

Key words Heart failure Vitamin D Vitamin D deficiency Renin CRP Prognosis



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