Mortality risk is increased in chronotropic incompetent device carriers with acute heart failure

M. Huttelmaier1, S. Muensterer2, C. Morbach2, F. Sahiti2, N. Scholz2, J. Albert2, C. Angermann2, G. Ertl2, S. Frantz1, S. Stoerk2, T. Fischer1
1 University Hospital Würzburg, Department of Internal Medicine 1, Würzburg, Germany; 2 University of Würzburg, Comprehensive Heart Failure Centre (CHFC) Würzburg, Würzburg, Germany

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Introduction: In heart failure (HF), chronotropic incompetence is a major factor limiting cardiac output and exercise capacity. In patients carrying cardiac implantable electronic devices (CIED), accelerometer-based rate adaption (R-mode) counterbalances chronotropic incompetence during physical activity but fails to modulate heart rate under circumstances of high metabolic demand.

Purpose: We hypothesized that an activated R-mode, a surrogate of chronotropic incompetence, indicates worse prognosis during and after episodes of acutely decompensated HF (AHF).

Methods: We analysed 632 patients enrolled between 01/2014 and 02/2018 in an ongoing registry that phenotypes and follows patients admitted for AHF. We compared CIED carriers with activated R-mode (CIED-R; n=37, 16% women) with CIED carriers not in R-mode (CIED-0; n=64, 23% women) and patients without CIEDs (no-CIED; n=511, 43% women). Information on survival status was collected up to 12 months after discharge from index hospitalisation (IH). Uni- and multivariable Cox proportional hazard regression was used to identify predictors of 12-month mortality risk.

Results: Mean age of the study sample was 74 (11) years, 39% were women, median LVEF on admission was 51 (quartiles 32, 59) % and de novo HF was detected in 20% of all patients. Median length of IH was 10 (7, 14) days. In-hospital mortality was similar across groups, but 12-month mortality risk was affected by chronotropic incompetence as indicated by R-mode activation: age- and sex-associated hazard ratio (HR) for CIED-R was 2.61 (95% CI 1.59–4.29, p<0.001) compared to group no-CIED, and 2.44 (95% CI 1.25–4.74, p=0.009) compared to group CIED-0. Amongst univariable predictors of mortality risk, strong associations were found for NT-proBNP levels (p<0.001), Charlson comorbidity index (p=0.001), and de novo HF (p=0.003). These effects persisted after multivariable adjustment for comorbidity burden. Within CIED-R, mortality risk was similar in patients with pacemakers vs. ICDs (HR 1.20, 95% CI 0.49–2.95) and in subgroups with LVEF <50% vs. ≥50% (HR 1.10, 95% CI 0.79–1.53). Mean heart rate on admission was lower in CIED-R vs. CIED-0 or no-CIED (70 bpm vs. 80 bpm or 82 bpm; both p<0.001). Heart rate on admission had no impact on frequency of in-hospital worsenings or death. However, we found a 36% increase in mortality risk per tertile of heart rate at discharge (HR 1.36, 95% CI 1.10–1.69, p=0.004) after exclusion of patients with an activated R-mode.

Conclusion: In AHF, R-mode stimulation was associated with an increased 12-month mortality risk, independent of LVEF, type of CIED, burden of comorbidities and type of presentation. Further, increased resting heart rate at discharge predicted 12-month mortality risk only in patients without an activated R-mode. Our findings suggest that chronicotropic incompetence per se worsens outcome in AHF and may not be adequately treated through accelerometer-based R-mode stimulation.

Fig 1: Mortality risk during the 12-month follow-up period by tertiles of resting heart rate (HR) at discharge from hospital.

Fig 2: Mortality risk (Kaplan Meier plot) during the 12-month follow-up period by CIED group. Comparison of group CIED-R (CIED with rate adaptive pacing), CIED-0 (CIED w/o rate adaptive pacing) and no-CIED (no CIED).