Short-Term Heart Rate Variability Strongly Predicts Sudden Cardiac Death in Chronic Heart Failure Patients

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Background— The predictive value of heart rate variability (HRV) in chronic heart failure (CHF) has never been tested in a comprehensive multivariate model using short-term laboratory recordings designed to avoid the confounding effects of respiration and behavioral factors.

Methods and Results— A multivariate survival model for the identification of sudden (presumably arrhythmic) death was developed with data from 202 consecutive patients referred between 1991 and 1995 with moderate to severe CHF (age 52±9 years, left ventricular ejection fraction 24±7%, New York Heart Association class 2.3±0.7; the derivation sample). Time- and frequency-domain HRV parameters obtained from an 8' recording of ECG at baseline and during controlled breathing (12 to 15 breaths/min) were challenged against clinical and functional parameters. This model was then validated in 242 consecutive patients referred between 1996 and 2001 (validation sample). In the derivation sample, sudden death was independently predicted by a model that included low-frequency power (LFP) of HRV during controlled breathing ≤13 ms² and left ventricular end-diastolic diameter ≥77 mm (relative risk [RR] 3.7, 95% CI 1.5 to 9.3, and RR 2.6, 95% CI 1.0 to 6.3, respectively). The derivation model was also a significant predictor in the validation sample (P=0.04). In the validation sample, LFP ≤11 ms² during controlled breathing and ≥83 ventricular premature contractions per hour on Holter monitoring were both independent predictors of sudden death (RR 3.0, 95% CI 1.2 to 7.6, and RR 3.7, 95% CI 1.5 to 9.0, respectively).

Conclusions— Reduced short-term LFP during controlled breathing is a powerful predictor of sudden death in patients with CHF that is independent of many other variables. These
results refine the identification of patients who may benefit from prophylactic implantation of a cardiac defibrillator.

**Key Words:** heart failure • prognosis • nervous system, autonomic • respiration • death, sudden

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