

## COMPARISON OF LINEAR AND NONLINEAR MEASURES OF HEART RATE VARIABILITY IN PATIENTS WITH IMPLANTABLE DEFIBRILLATORS

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Heart rate variability (HRV) has not been well-characterized in very ill populations such as those patients receiving treatment for ventricular arrhythmias with an implantable cardioverter defibrillator (ICD). HRV changes in response to physical activity may reflect the modulatory effects of the neurocardiac control mechanisms. Thus, HRV assessment during activity may indicate illness severity. Nonlinear analysis of HRV may better ascertain the multidimensional processes controlling cardiac electrical function compared to linear techniques, since nonlinear analyses do not require a priori assumptions and data conditioning.

**PURPOSE:** This investigation examined the relationship between resting and walking HRV with both linear and nonlinear measures in patients at one-day / baseline (n = 31), 3-months (n = 15) and 6-months (n = 16) post-ICD insertion. Patients were predominantly married (77%), Caucasian (71%), males (74%) in NYHA Class II / III (69%) with an ejection fraction < 30% (77%) and mean age  $56 \pm 12$ .

**METHOD:** Subjects underwent two 10-minute Holter ECG recordings: one while resting supine followed immediately by one while walking. RR interval data obtained from electrocardiograms were then analyzed in the time domain via standard deviation (SDNN) and in the nonlinear domain with recurrence quantification analysis (RQA). The RQA technique produces seven variables which signify different aspects of nonlinear dynamics.

**FINDINGS:** Preliminary results showed that, at baseline, walking heart rate was significantly different from resting ( $p = 0.005$ ), but there were no differences between resting and walking SDNN and RQA variable values. At 3-months, both heart rate and SDNN resting / walking values were significantly different ( $p = 0.011$  and  $0.003$ , respectively), but not the RQA variable values. At 6-months, only the SDNN resting / walking values were significantly different ( $p = 0.03$ ), but not heart rate or the RQA variable values. ANOVA testing showed no significant differences over time for heart rate and all HRV variables.

**DISCUSSION:** These results demonstrate that the linear SDNN variable and the nonlinear RQA variables do not exhibit the same pattern in describing the relationship between resting and walking HRV. Additional studies investigating responses to activity with these measures are needed to better understand the neurocardiac interactions governing HRV in the ICD patient population.