EDITORIAL COMMENTARY

Even with a wearable ICD, get those steps in!

Virginia Workman, MD, Rachel Lampert, MD, FHRS

From the Yale University School of Medicine, New Haven, Connecticut.

Although observed rates of sudden cardiac death (SCD) are lower in men compared to women with comparable risk factors, an estimated 120,000 SCD events occur in women annually, representing a major public health issue in this population.[1] Clinical differences in presentation of SCD based on sex are well described, with a higher percentage of events in women occurring in the absence of a preexisting diagnosis of heart disease.[2] At a basic cellular level, there are sex-specific and hormonal differences in autonomic regulation, calcium handling, and other properties that modify arrhythmia risk and presentation in the female population.[3] Risk factors and clinical predictors for SCD in women therefore remain important areas of focus in the clinical literature.

Among large multicenter trials evaluating implantable cardioverter-defibrillator (ICD) outcomes, women represent between one-fourth and one-fifth of all participants analyzed.[4] In addition to lower rates of enrollment, rates of appropriate ICD interventions are overall lower in women participants compared to men. These factors combined translate to low event rates in women and low confidence in sex-specific subgroup analyses of predictors of ventricular arrhythmia (VA) and SCD.

In this issue of *Heart Rhythm O*^{2}, Burch and colleagues[5] report an analysis of a population of female patients prescribed a wearable cardioverter-defibrillator (WCD) following a myocardial infarction or new diagnosis of dilated cardiomyopathy. Estimated physical activity derived from step counts measured by the WCD accelerometer was analyzed in patients receiving both appropriate and inappropriate shocks. This large database of 4928 women with 120 appropriate shocks for VA affords the robust sample size and event rate required to lend insight into a complex relationship between activity and arrhythmia. The authors determined based on curve estimation that while overall, activity increased in the month after myocardial infarction or cardiomyopathy diagnosis, there was a significant decline in activity beginning 2 weeks prior to the shock that was unique to patients experiencing appropriate shocks for VA.

As the authors suggest, the relationship between VA and decline in physical activity is likely multifactorial. It is reasonable to assume that worsening heart failure functional status contributes in part to lower step counts in the cohort of patients receiving appropriate WCD shocks for VA, though the association may also reflect a more direct causative mechanism of decreased exercise on VA. In terms of heart failure functional class, the incidence of SCD is known to be lower overall in patients described as New York Heart Association (NYHA) class I compared to more advanced functional classes,[6] and decline in functional capacity is assumed to confer incremental risk for VA. The population of patients analyzed in this study represents a demographic commonly described as being in a "transition phase" from hospital discharge to community care, which is known to be high risk for major adverse cardiac events and heart failure readmissions. Owing to the magnitude of healthcare-associated costs, morbidity, and mortality observed in this population, many stakeholders have invested significant resources in trials designed to optimize outcomes in this demographic to prevent readmissions and improve outcomes. A frequent focus of these interventions is improving adherence rates to medications and lifestyle modifications[7]; however, this study selected for a population that was highly compliant based on WCD wear time metrics, highlighting the need for additional interventions to improve outcomes.

It is also possible that the findings reflect a causative association between exercise and cardiac health.[8] There is compelling data to suggest a protective effect of exercise against developing coronary disease and its risk factors and a favorable effect of routine exercise on outcomes in patients with pre-established diagnoses of coronary disease, leading to the widespread adoption of rehabilitation programs following hospitalizations for coronary events and heart failure. However, the relationship between physical activity and VA has also been described as paradoxical, because overall, increased regular physical exertion is protective against cardiac and sudden death,[7] but acutely, exercise acts as a trigger.[9] Physiologically, however, these effects are consistent with the autonomic effects of exercise and the autonomic influences on arrhythmia. Habitually increased levels of exercise result in increased vagal tone, which is known to confer a protective effect against ventricular arrhythmia.[10] Conversely, acute increases in physical activity in the setting of overall deconditioning can predispose to a proarrhythmic sympathetic surge.[11]

Address reprint requests and correspondence: Dr Rachel Lampert, Yale Cardiology, 789 Howard Ave, Dana 319, New Haven, CT 06520. E-mail address: rachel.lampert@yale.edu.

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There is ample precedent for the clinical utility of physical activity estimates derived from implantable device accelerometers, and Burch and colleagues[12] have previously demonstrated correlations between low step counts as measured by WCD external accelerometers and incidence of VA. It has been established that physical activity measurements from implanted devices perform well as a surrogate for NYHA functional class and hold predictive value in models estimating risk for VA, SCD, and other adverse cardiac events.[13] It follows that frequent assessment of activity levels in this vulnerable population and counseling on lifestyle modification with a goal of steady increases in physical activity may improve arrhythmia-free survival. Though quantitative data is not currently accessible by patients directly from the device manufacturers, providers with access to this data may be able to play a role in forming concrete activity goals and surveillance of activity trends.[13]

In recent years, remote monitoring of a multitude of metrics derived from implantable device data, including physical activity, has become a valuable addition to care incorporated into most device clinic models.[14] For patients without prescribed or implanted devices, wearable accelerometers have also become widely embraced in the community, and healthcare providers have become increasingly facile with incorporating patient-generated healthcare data such as step counts and heart rate trends into care plans and counseling strategies. These devices provide an objective means for estimating activity levels in patients without implantable devices, which is not susceptible to the recall bias for which patient activity diaries are commonly criticized.

Burch and colleagues describe a 2-week trend of decreased activity levels prior to VA in women with newly diagnosed cardiomyopathies. These findings highlight the need for a system to establish close follow-up after discharge with special attention to activity level trends during this initial vulnerable period. Frequent follow-up of activity data in women in the initial month following a diagnosis of heart failure, whether using devices such as WCDs or commercially available wearable accelerometers, may allow for timely intervention to prevent adverse arrhythmia and heart failure outcomes.

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