Remote Monitoring of Implantable Defibrillators
Reducing Hospitalizations and Saving Lives?

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Remote monitoring of implantable cardioverter defibrillators (ICDs) and pacemakers was first introduced in 2001. Initially, this approach added some efficiencies to device follow-up programs as well as patient convenience particularly for those who are geographically isolated from their device follow-up clinic. As the technology evolved during the past decade permitting automatic remote device interrogation as well as the availability of programmable alerts and communication of this information to healthcare providers without the active participation of the patient, this has led to improved patient benefits including early detection of device malfunction or programming concerns as well as early detection of some disease-specific parameters, such as arrhythmias and heart failure. The clinical benefits of remote monitoring have been demonstrated in many randomized clinical trials and its routine use has been recommended by professional societies.¹

Data harbored within the device manufacturers’ remote monitoring databases following hundreds of thousands of patients has provided a fertile field for patient outcomes studies. The ALTITUDE investigators used data from the Boston Scientific remote monitoring system LATITUDE to study survival in patients receiving ICDs or cardiac resynchronization therapy defibrillators.² In this analysis, 1- and 5-year survival rates were higher in the 69,556 patients followed remotely than in the 116,222 patients followed through device clinics only (50% relative risk reduction, P<0.001). More recently, investigators used data from 269,471 patients obtained from the St Jude Medical Merlin remote monitoring network to determine whether remote monitoring was associated with improved survival and whether this outcome was influenced by the type of device or frequency of use.³ The authors reported that remote monitoring was associated with improved survival compared with those who never used remote monitoring, that the survival benefit was significantly improved by a high degree of compliance to this follow-up strategy and that the survival benefit was observed for patients with ICDs, cardiac resynchronization therapy systems, and pacemakers.

These 2 studies have several limitations that potentially confound the data interpretations and conclusions. Patients were not randomized to the follow-up strategy and thus significant differences in the characteristics of patients followed remotely compared with those followed directly in the follow-up clinic likely exist. Apart from age and sex, no information is provided about the characteristics of patients who did not use remote monitoring or used it less frequently. No data on patient comorbidities and the severity of these comorbidities or other factors that might influence survival and other health outcomes are provided because such data are not collected in these large device monitoring databases. The Merlin registry investigators attempted to evaluate some socioeconomic factors, which are already known to be associated with health outcomes and survival by linking patient postal codes to US Census Bureau survey data.⁴ Not surprisingly, factors associated with higher socioeconomic status were associated with the use of remote monitoring although the magnitude of this association was small. It is possible that users of remote monitoring are healthier, have healthcare insurance, are more engaged with their healthcare and compliant to medical therapy including follow-up and that the use of remote monitoring did not facilitate survival but is just a marker of these other traits. Indeed, analysis of a subset of the ALTITUDE cohort linked to the National Cardiovascular Data Registry ICD Registry supports this likelihood.⁵ In this latter analysis involving 39,158 patients with newly implanted devices capable of remote monitoring, age, race/ethnicity, health insurance, geographic location, and health-related factors influenced the use of remote monitoring. Patients lacking health insurance, blacks, hispanics, other ethnic minorities, and those with significant comorbidities including heart failure, lung disease, and renal dysfunction were less likely to use remote monitoring.

In this current issue of Circulation: Arrhythmia and Electrophysiology, Akar et al⁶ evaluated the relationship between the use of remote monitoring of ICD recipients and clinical outcomes, including all-cause mortality and all-cause rehospitalization. The data set included 37,742 patients followed in both the National Cardiovascular Data Registry ICD registry and the ALTITUDE registry. The authors report a significant reduction in mortality in patients followed with remote monitoring compared with those not using remote monitoring (hazard ratio, 0.67; 95% confidence interval [CI], 0.64–0.71; P<0.0001). Furthermore, the 3-year all-cause rehospitalization rate in the subset of Medicare patients (n=15,254) was significantly lower in the group followed with remote monitoring than in those not using this technology (hazard ratio,
The use of the time-varying Cox regression model prevented analysis of cause-specific hospitalization (J. Akar, personal communication). This is an important issue that needs to be addressed in future data analyses.

The true impact of remote monitoring of ICDs and pacemakers on survival and rehospitalization is likely lower than reported in these observational studies. Nevertheless, the benefits of remote monitoring of implantable cardiac devices are well recognized and it is thus surprising that this technology remains underused even in geographies where its use is covered by healthcare insurance. Taken together, the results of these observational studies are intriguing and provide a compelling argument for promoting efforts to identify and eliminate the barriers currently preventing broader implementation of remote patient management strategies.

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