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Impact of a Novel Adaptive Optimization Algorithm on 30-Day Readmissions

Evidence From the Adaptive CRT Trial

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ABSTRACT

OBJECTIVES This study investigated the impact of the Medtronic AdaptivCRT (aCRT) (Medtronic, Mounds View, Minnesota) algorithm on 30-day readmissions after heart failure (HF) and all-cause index hospitalizations.

BACKGROUND The U.S. Hospital Readmission Reduction Program, which includes a focus on HF, reduces Medicare inpatient payments when readmissions within 30 days of discharge exceed a moving threshold based on national averages and hospital-specific risk adjustments. Internationally, readmissions within 30 days of any discharge may attract reduced or no payment. Recently, cardiac resynchronization therapy (CRT) devices equipped with the Medtronic AdaptivCRT (aCRT algorithm allowing automated ambulatory device programming were introduced. The Adaptive CRT trial demonstrated the algorithm's safety and comparable outcome against a rigorous echocardiography-based optimization protocol.

METHODS We analyzed data from the Adaptive CRT trial, which randomized patients undergoing CRT defibrillation on a 2:1 basis to aCRT (n = 318) or to CRT with echocardiographic optimization (Echo, n = 160) and followed up these patients for a mean of 20.2 months (range 0.2 to 31.3 months). Logistic regression with generalized estimating equation methodology was used to compare the proportion of patients hospitalized for HF and for all causes who had a readmission within 30 days.

RESULTS For HF hospitalizations, the 30-day readmission rate was 19.1% (17 of 89) in the aCRT group and 35.7% (15 of 42) in the Echo group (odds ratio: 0.41 [95% confidence interval (CI): 0.19 to 0.86], p = 0.02). For all-cause hospitalization, the 30-day readmission rate was 14.8% (35 of 237) in the aCRT group compared with 24.8% (39 of 157) in the Echo group (odds ratio: 0.54 [95% CI: 0.31 to 0.94], p = 0.03). The risk of readmission after HF or all-cause index hospitalization with aCRT was also significantly reduced beyond 30 days.

CONCLUSIONS Use of the aCRT algorithm is associated with a significant reduction in the probability of a 30-day readmission after both HF and all-cause hospitalizations. (Adaptive Cardiac Resynchronization Therapy Study (aCRT); NCT00980057) (J Am Coll Cardiol HF 2015;■:■–■) © 2015 by the American College of Cardiology Foundation.

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ABBREVIATIONS AND ACRONYMS

aCRT = AdaptivCRT

AV = atrioventricular

CMS = Centers for Medicare and Medicaid Services

CRT = cardiac resynchronization therapy

Echo = echocardiographic optimization

HF = heart failure

HRRP = Hospital Readmissions Reduction Program

LV = left ventricle

NYHA = New York Heart Association

RV = right ventricle

Cardiac resynchronization therapy (CRT) is an established therapy for patients with heart failure (HF) symptoms, left ventricular (LV) systolic dysfunction, and a wide QRS (1,2). CRT has been shown to improve functional capacity and quality of life (1), reduce mortality and hospitalization (3,4), reverse the cardiac remodeling process (1), and be cost-effective (5–7). However, not all patients respond to CRT (8), resulting in a failure to realize maximal potential reductions in the incidence of HF and repeated hospitalizations.

In the United States, the introduction of the Affordable Care Act added to the Social Security Act, and the Hospital Readmissions Reduction Program (HRRP) was established (9). This program reduces all Medicare inpatient payments when readmissions within 30 days of discharge from an "index admission" exceed a moving threshold based on national averages and hospital-specific risk adjustments. Inpatient admissions for HF were one of the first hospitalization types identified in the rules of this program as relevant "index admissions." Although the United States and other countries have different modes of implementation (10), reducing early readmissions to the hospital is becoming an international policy priority aimed at reducing costs and improving the quality of health care (11).

The Adaptive CRT clinical trial (12) demonstrated that a novel algorithm for delivering CRT was at least as effective as protocol-driven echocardiographic optimization. The time to first HF admission was found to be similar for aCRT patients and patients who underwent traditional echocardiographic optimization; the initial report that was published did not include the overall number of admissions per patient (HF or otherwise). The AdaptivCRT (aCRT) algorithm (Medtronic, Inc., Mounds View, Minnesota) automatically adjusts atrioventricular (AV) and interventricular delays on the basis of frequent evaluation of the patient's underlying conduction (13). Specifically, the algorithm provides LV-only pacing synchronized to right ventricular (RV) activation when intrinsic AV conduction is normal or biventricular pacing when AV conduction is prolonged.

Whellan et al. (14) studied patients with CRT devices and an HF hospitalization. These investigators reported that risk of readmission within 30 days of the index hospitalization was increased when certain device-derived diagnostic criteria, such as high atrial fibrillation burden with poor rate control, were present 7 days after the index hospitalization. Of note, Martin et al. (15) also have reported a reduction in atrial fibrillation with use of the aCRT algorithm. Despite the high volume of research in the risk of HF hospitalization in general, we are not aware of any other studies that evaluated the risk of readmission within 30 days among patients with a CRT defibrillator. In the present study, we evaluated the impact of the aCRT algorithm on 30-day hospital readmission rate compared with conventional CRT optimized by echocardiography. We examined readmissions after either HF or all-cause index hospitalization.

METHODS

The design and primary results of the Adaptive CRT trial have been previously published (12,13). Briefly, the Adaptive CRT trial was a prospective, multicenter, randomized, double-blind clinical trial comparing aCRT with therapy dynamically adjusted by the algorithm to standard biventricular pacing with AV and interventricular settings optimized through use of a standardized, rigorous, echocardiographic protocol (Echo arm). The trial enrolled patients who did not have permanent atrial tachyarrhythmias and had clinical indications for implantation of a de novo CRT defibrillator system. The clinical indication at the time of enrollment was New York Heart Association (NYHA) functional class III or IV HF symptoms, LV ejection fraction of $<35\%$, and QRS duration of ≥ 120 ms while receiving optimal medical therapy. Primary objectives were met, demonstrating the algorithm's safety and effectiveness of improving patient 6-month response rate at a rate similar to that of the Echo arm.

OUTCOME MEASURES. Data regarding all hospitalizations were collected prospectively during the trial. Readmission within 30 days was assessed by identifying "index hospitalizations" that could fall under the HRRP or other international rules and determining for each one whether any subsequent hospital readmission occurred >1 day and ≤ 30 days after discharge. These readmissions would have been counted toward financial penalties. In alignment with the manner in which the Centers for Medicare and Medicaid Services (CMS) is measuring hospitals in the United States, our analysis specified an index hospitalization as having at least 30 days of patient follow-up after discharge, and no hospitalization was counted as both an index hospitalization and a readmission. Both all-cause and HF-related index hospitalizations were assessed. Hospitalizations for device implants were included only if investigators considered them to be related to HF. For hospitalizations lasting at least 24 hours, relatedness to HF was