Prophylactic Defibrillators in Patients With Severe Chronic Kidney Disease

Heart failure (HF) and chronic kidney disease (CKD) are increasing in prevalence individually and in combination.\(^1\) It is unclear whether the survival benefits associated with prophylactic implantable cardioverter defibrillator (ICD) implantation in traditional populations extends to individuals with severe CKD (stage ≥4 or estimated glomerular filtration rate [eGFR] <30 mL/min/1.73 m\(^2\)) given their underrepresentation in clinical trials\(^2\) and elevated risk of non–cardiac-related death.\(^3\) The absence of data and presence of competing risks complicates decision-making in this population. This study assessed the association between prophylactic ICD implantation and survival in individuals with severe CKD.

**Methods** | This study was approved by the institutional review board of Sunnybrook Health Sciences Centre. Patients with HF and non–dialysis-dependent severe CKD undergoing prophylactic ICD implantation in the Ontario ICD database from February 2007 through November 2011 were identified.\(^4\) Patients with HF, defined using the Framingham criteria, and severe CKD not receiving an ICD were identified in the Enhanced Feedback for Effective Cardiac Treatment (EFFECT Phase II) study\(^5\) from 2004 through 2005. Only patients with a documented ejection fraction of less than 35%, surviving at least 40 days postdischarge, and assessed by a cardiologist were included. A propensity-score matched cohort of patients with and without ICD (hereinafter, ICD group and non-ICD group) was created using a greedy, nearest-neighbor matching algorithm. Variables in the propensity score included sex, eGFR, QRS duration, atrial fibrillation, prior revascularization, medications, comorbidities, and number of hospitalizations for HF or myocardial infarction (MI) in the preceding 5 years. In addition, patients were matched from the time of their last hospitalization for HF or MI.

Kaplan-Meier estimates of survival were determined for each group and compared using the stratified log-rank test. A robust variance estimator was used to account for the matched nature of the sample. The Cox model was adjusted for baseline covariates whose standardized difference exceeded 0.1 in the matched sample. All analyses were performed using SAS statistical software (version 9.3; SAS institute Inc), with a 2-tailed \(P < .05\) indicating statistical significance.

**Results** | A total of 108 unique pairs of patients (87% of eligible patients in ICD group) were matched (Table). Imbalances in age,
QRS duration, hypertension, prior MI, additional comorbidities, and medication use were distributed in a pattern that potentially disadvantaged the non-ICD group. The mortality rates were 16.7 deaths per 100 person-years in the ICD group vs 17.1 per 100 person-years in the non-ICD group ($P = .92$) (Figure). The unadjusted hazard ratio (HR) for death in the ICD group was 1.05 (95% CI, 0.63-1.74; $P = .86$). After adjusting for variables with imbalance, the HR was 2.21 (95% CI, 0.45-10.8; $P = .33$).

**Discussion** | Our data suggest that prophylactic ICD implantation may not confer a survival advantage in patients with HF and severe CKD. The primary limitation of our work was that ICD implantation was not randomized. Despite rigorous methods to adjust for the propensity of ICD receipt, including additional analyses adjusting for variables with imbalance, residual confounding cannot be excluded. The strengths of our work include the sample size (which to our knowledge is the largest matched cohort of patients with advanced CKD receiving ICDs), rich clinical data, and follow-up available in the population-based databases employed.

The results of our study are not unexpected. It is well known that patients with severe CKD are at increased risk for device-related infections, increased defibrillation thresholds, refactoriness to electrical therapy, and non-cardiac-related death, which may erode the survival benefit afforded by ICD implantation. Despite this, current device guidelines place no restrictions on prophylactic ICD implantation based on stage of CKD. Our findings, in combination with other studies, suggest that, despite the increasing prevalence of CKD and HF, prophylactic ICD implantation in this group of patients, such work is critical to avoid the twin traps of overtreatment and therapeutic nihilism.

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