

Heart failure hospitalizations and associated costs in ICD/CRT-D recipients following device replacement or upgrade: insights from the DECODE registry

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BACKGROUND

Heart failure hospitalizations (HFHs) likely represent the main health care expenditure also in implantable cardiac defibrillators (ICDs) and cardiac resynchronization therapy defibrillators (CRT-D) recipients yet the event rate of HFH and the associated costs after device replacement or upgrade are unknown.

METHODS

The Detect long-term COmplications after icD rEplacement (DECODE) was a prospective, single-arm, multicenter cohort study exploring complications in ICD/CRT-D recipients undergoing device replacement or upgrade from ICD to CRT-D. All clinical and survival data of these patients at 12-month follow-up were prospectively analyzed. For each adjudicated HFH, the admission and discharge date were recorded, and ICD-9-CM diagnoses and procedure codes were obtained. The estimated reimbursement for each hospitalization was calculated according to the 2012 Italian national reimbursement rates.

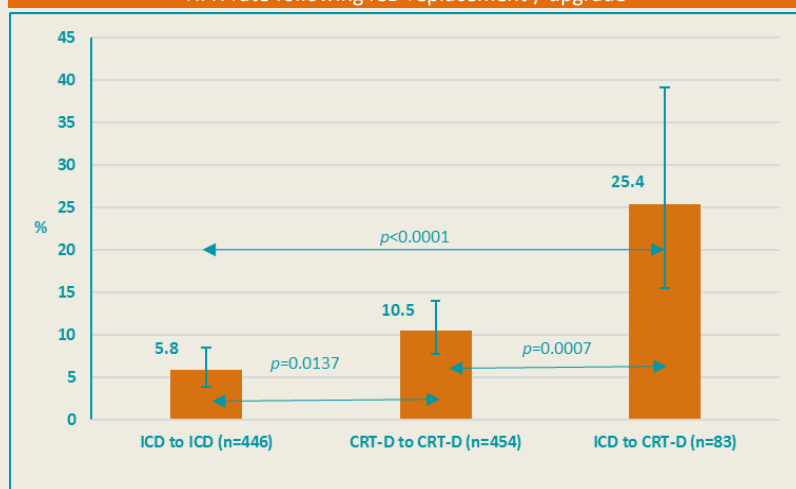
PURPOSE

To report HFH rates and associated costs within 12 months following ICD/CRT-D device replacement or upgrade procedure from ICD to CRT-D.

RESULTS

Between 2013 and 2015, 983 patients (mean age = 71 years, mean LVEF = 35%, NYHA class I/II = 75.6%) were enrolled: 900 (91.6%) patients underwent device replacement (446 ICD/454 CRT-D) and 83 (8.4%) upgrade from ICD to CRT-D. After 12 months, 66 (6.7%) patients died, 40 (60.6%) for cardiovascular reasons. Fifty-five (5.6%) patients experienced at least 1 HFH. Overall, 91 HFH (9.6% event rate 95%CI, 7.7-11.7%) occurred.

HFH rate following ICD replacement / upgrade



Clinical and demographic data	
Age, y	71 [63-77]
LVEF, %	35 [30-45]
BMI, kg/m ²	26.3 [24-29.4]
eGFR, ml/min	63.3 [44.5-84]
Gender Male, n (%)	750 (76.3)
NYHA I, n (%)	191 (19.4)
NYHA II, n (%)	553 (56.3)
NYHA III, n (%)	225 (22.9)
NYHA IV, n (%)	14 (1.4)
History of AF, n (%)	372 (37.8)
AV node ablation, n (%)	41 (4.2)
Ischemic Cardiomyopathy, n (%)	537 (54.6)
PTCA/CABG within 6 months prior to the procedure, n (%)	95 (9.7)
Diabetes, n (%)	282 (28.7)
Hypertension, n (%)	608 (61.9)
Chronic Kidney Disease, n (%)	249 (25.3)
Hospitalization within 30 days prior to the procedure, n (%)	73 (7.4)

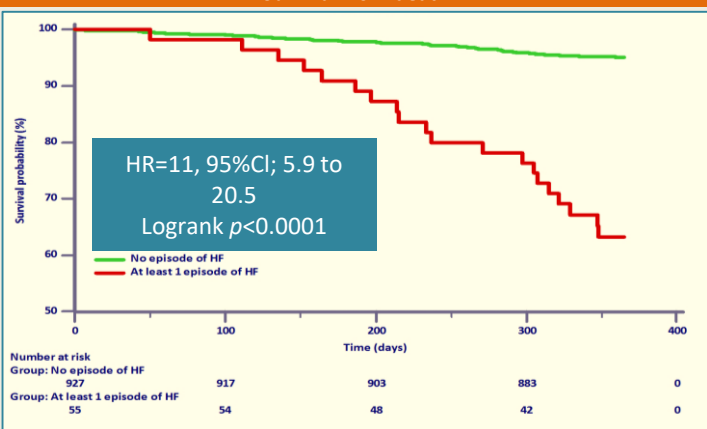
Device Replaced	
Single-chamber/VDD, n (%)	262 (26.6)
Double-chamber, n (%)	261 (26.6)
CRT-D, n (%)	460 (46.8)

Pharmacological treatment	
ACE Inhibitors, n (%)	555 (56.5)
Ivabradine, n (%)	59 (5)
ARBs, n (%)	186 (18.9)
β-Blockers, n (%)	839 (85.4)
Statins, n (%)	515 (52.4)
Loop Diuretics, n (%)	701 (71.3)
K ⁺ Diuretics, n (%)	448 (45.6)
Amiodarone, n (%)	218 (22.2)
Oral Antidiabetics, n (%)	164 (16.7)
Insulin, n (%)	99 (10.1)
Warfarin, n (%)	408 (41.5)
DOAC, n (%)	3 (0.3)
Single antiplatelet, n (%)	402 (40.9)
Dual Antiplatelet, n (%)	35 (3.6)
Warfarin + antiplatelet, n (%)	113 (11.5)

Among the variables tested at univariate analysis, only LVEF ≤ 35%, AF history and renal disease were confirmed as HFH predictors at multivariate analysis. HFH rate was significantly higher following upgrade procedures and occurrence of HFH was associated with an eleven-fold increased mortality risk (95%CI: 5.9 to 20.5; p<0.0001).

The cumulative cost associated with HFHs incurred over the 12 months follow-up was 515305 €. The mean cost per HFH was 5662±9497 € [ranging from 3144 € to 64479 €] while the mean cost per patient with events was 9369±12687 €.

Survival from death



Variable	HR	95% CI	p value	HR	95% CI	p value
History of atrial fibrillation	2.2	1.29 to 3.72	0.004	1.78	1.03 to 3.07	0.0402
BMI	0.93	0.87 to 1.02	0.0589			
Ischemic Cardiomyopathy	1.2	0.7 to 2.04	0.507			
Age ≥ 75 years	1.42	0.84 to 2.41	0.1973			
CKD	1.72	1.6 to 4.64	0.0002	2.07	1.2 to 3.57	0.0093
Insulin	1.62	0.77 to 3.42	0.2086			
LVEF ≤ 35%	2.83	1.43 to 5.61	0.0029	2.22	1.1 to 4.47	0.0264
NYHA class III/IV vs I/II	2.24	1.3 to 3.84	0.0037	1.62	0.93 to 2.81	0.0896
COPD	1.37	0.74 to 2.55	0.3242			
Gender male	0.82	0.45 to 1.48	0.5026			
Current smoker	0.29	0.04 to 2.07	0.2182			
Hypertension	0.66	0.39 to 1.12	0.1255			

CONCLUSION

Underlying cardiac disease and renal failure are the main drivers of HFH and mortality, and of higher healthcare expenditures in ICD/CRT-D recipients following device replacement or upgrade. Accurate clinical assessment is needed to support the decision-maker at the time of ICD replacement to take an appropriate clinical and economic sustainable decision.