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Performance and Safety of the Extravascular Implantable Cardioverter-Defibrillator Through Long-Term Follow-Up: Final Results From The Pivotal Study

Running title: *Friedman et al.; Final EV ICD Pivotal Study Results*

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Abstract

Background: Substernal lead placement of the extravascular implantable cardioverter-defibrillator (EV ICD) permits both defibrillation at thresholds similar to those seen with transvenous ICDs and effective antitachycardia pacing (ATP), while avoiding the vasculature and associated complications. The global Pivotal study has shown the EV ICD system to be safe and effective through 6 months, but long-term experience has yet to be published. We aim to report the performance and safety of the EV ICD system throughout the study.
Methods: The EV ICD Pivotal study was a prospective, global, single-arm, pre-market clinical study. Individuals with a class I or IIa indication for a single-chamber ICD per guidelines were enrolled. Freedom from major system- or procedure-related complications, as well as appropriate and inappropriate therapy rates, were assessed through 3 years using the Kaplan-Meier method. Anti-tachycardia pacing success was calculated using simple proportions.
Results: An implant was attempted in 316 patients [25.3% female, 53.8±13.1 years old, 81.6% primary prevention, LVEF 38.9%±15.4%]. Of 299 patients with a successful implant, 24 experienced 82 spontaneous arrhythmic episodes that were appropriately treated with either ATP only (38, 46.3%), shock only (34, 41.5%), or both (10, 12.2%) for a Kaplan-Meier-estimated rate of first any appropriate therapy of 9.2% at 3 years. Antitachycardia pacing was successful in 77.1% (37/48) of episodes, and ATP usage significantly increased from discharge to last follow-up visit (P<0.0001). Shock therapy was successful in 100% (27/27) of discrete, spontaneous ventricular arrhythmias. The inappropriate shock rates at 1 and 3 years were 9.8% and 17.5%, respectively, with P-wave oversensing the predominant cause. No major intraprocedural complications were reported and the estimated freedom from system- or procedure-related major complications was 91.9% at 1 year and 89.0% at 3 years. The most common major complications were lead dislodgement (10 events; n=9 patients, 2.8%), postoperative wound or device pocket infection (n=8, 2.5%), and device inappropriate shock delivery (n=4, 1.3%). Twenty-four system revisions were performed as a result of major complications related to the EV ICD system or procedure.
Conclusions: From implant to study completion, the EV ICD Pivotal study demonstrated that a single integrated system with an extravascular lead placed in the substernal space maintains high ATP success, effective defibrillation, and a consistent safety profile.
Clinical Trial Registration: ClinicalTrials.gov; Identifier: NCT04060680

Keywords: antitachycardia pacing, ATP, extravascular ICD, primary prevention, secondary prevention, substernal, sudden cardiac death, ventricular arrhythmias

Non-standard Abbreviations and Acronyms

ATP	antitachycardia pacing
EV ICD	extravascular implantable cardioverter-defibrillator
ICD	implantable cardioverter-defibrillator
IDE	investigational device exemption
GEE	generalized estimating equations
KM	Kaplan-Meier
PHD	pre-hospital discharge
S-ICD	subcutaneous ICD
VF	ventricular fibrillation
VT	ventricular tachycardia

Clinical Perspective

What is new?

- The first extravascular defibrillation system with a susbsternal lead effectively delivers ATP, successfully terminating 77% of episodes where ATP was utilized, during a mean follow-up of 30.6 months.
- The EV ICD system provides effective defibrillation therapy during long-term follow-up, terminating 100% of discrete, spontaneous ventricular arrhythmias.
- In this study, the EV ICD system had a rate of freedom from system- or procedure-related major complications of 89% at 3 years. No major intraprocedural complications occurred, nor any unique major ICD complications related to the EV ICD system or procedure from implant through final follow-up.

What are the clinical implications?

- The EV ICD system provides effective treatment of potentially life-threatening ventricular arrhythmias in the long-term, avoiding shocks in almost half of spontaneous VT/VF episodes due to the availability of ATP.
- Only a minority of complications occurred after the previously reported six-month follow-up, demonstrating the safety of the EV ICD over longer timeframes in the Pivotal study.

Introduction

Implantable cardioverter-defibrillators (ICDs) are established therapy for reducing the incidence of sudden cardiac death in at-risk populations.[1,2] Traditional transvenous placement of an ICD lead can result in serious complications both in the short- and long-term including vascular injury, venous obstructions, systemic infections, cardiac perforation, and complications during chronic lead extraction.[3-5] The subcutaneous ICD (S-ICD) was introduced as an alternative to transvenous systems, placing the lead between the skin and the sternum.[6,7] By avoiding the vasculature, the S-ICD reduces the number and severity of complications compared to transvenous ICDs while effectively terminating ventricular arrhythmias.[8] However, it does not provide antitachycardia pacing (ATP) and its location outside the chest wall necessitates a larger generator for higher energy shocks, which can impact battery longevity.[6,9]

The extravascular ICD (EV ICD) was developed to provide the benefits of circumventing the vasculature while retaining many of the capabilities of a transvenous ICD system. Substernal lead placement of the EV ICD allows for ATP and defibrillation therapy from a single device, with a similar size, projected longevity, and defibrillation threshold to that of transvenous systems while being outside the vasculature.[10-12] Results from the first in-human Pilot study, conducted in a small cohort of patients, showed the EV ICD system could be safely implanted and deliver effective defibrillation.[10,13] These findings were validated in the subsequent Pivotal study in which the primary results exceeded safety and efficacy criteria in a large, global population through 6 months follow-up.[11] We now report the safety and efficacy of the EV ICD system through extended follow-up of the Pivotal study.

Methods

The data underlying these results will not be made available to other researchers for the purposes of reproducing the results or replicating the procedures.

Study design and patient selection

The EV ICD Pivotal study design has been described in detail previously.[14] Briefly, it was a prospective, global, multicenter, single-arm, non-randomized, pre-market approval study that enrolled patients between 2019 and 2021 with a Class I or IIa indication for an ICD as recommended by international guidelines.[15] Patients were excluded if they had a bradycardia or cardiac resynchronization therapy pacing indication or had undergone prior sternotomy (full exclusion criteria in Supplemental Table 1). Patients with a successful implant attempt were followed and assessed at pre-hospital discharge (PHD), 2 weeks, 3 months, 6 months, and every 6 months thereafter until exited from the study. The study protocol was approved by ethics committees at each participating site, and written informed consent was provided by all study patients.

Objectives

The primary safety endpoint of the Pivotal study was freedom from system- or procedure-related major complications at 6 months, and that same endpoint was assessed in this current analysis through 3 years. We also examined the appropriate and inappropriate therapy rates through 3 years. Data that were collected via case report forms at each follow-up visit, including reporting of ATP programming and electrical performance (R-wave amplitude, pacing capture threshold, pulse width, and impedance), are summarized through 3 years or last available follow-up. The total number of treated episodes (appropriate and inappropriate), ATP success, shock success, total major and minor complications, and system revisions were generated using data through

last available follow-up. Shock success was calculated for discrete, spontaneous episodes; success for shocks delivered as part of a ventricular tachycardia (VT) storm (three or more episodes within 24 hours) are summarized separately.

Adverse event and episode adjudication

All adverse events were adjudicated by a Clinical Events Committee. The committee determined if the event was related to the EV ICD system or procedure and, for those that were related, if it was a major complication, minor complication, or an observation. All induced episodes, all device-detected spontaneous episodes (excluding non-sustained VTs of ≤ 5 seconds in duration), and all episodes receiving device therapy were adjudicated as appropriate or inappropriate by an Episode Review Committee. Several events required re-adjudication during the study, and additional details can be found in the Supplemental Methods.

Statistical Analysis

Descriptive statistics are reported using mean ± standard deviation or median for continuous variables and frequency and percentage for categorical variables. The freedom from major complication rate, appropriate therapy rate, and inappropriate therapy rate were generated using the Kaplan-Meier (KM) method. Antitachycardia pacing success rate was calculated using both simple proportions and the generalized estimating equations (GEE) method to account for within-patient correlation (see Supplemental Results). Change in ATP programming comparing PHD and last follow-up was assessed using the McNemar's test. All statistical analyses were performed using SAS version 9.4 (SAS Institute, Cary, NC, USA).

Results

Baseline characteristics

A total of 356 patients were enrolled, of whom 316 underwent an implantation attempt (25.3% female, age: 53.8±13.1 years old). Forty patients exited before undergoing an implant attempt, largely for administrative reasons (Supplemental Figure 1). Patients with an implant attempt had a mean left ventricular ejection fraction of 38.9% ± 15.4% and a majority (81.6%) underwent implantation for a primary prevention indication. A full list of patient baseline characteristics is provided in Table 1.

Follow-up

Implant attempt was successful in 299 patients, and those patients were followed for an average of 30.6 ± 8.5 months. The first implant occurred in September 2019 and last patient exited the study in January 2024. All subjects were followed for a minimum of 2 years, unless exited prior to study closure for other reasons; the longest follow-up was 4.2 years post-implant and one patient was lost to follow-up (Supplemental Figure 1).

Appropriate therapy

Through all of follow-up, appropriate therapy was received by 24 patients for 82 spontaneous arrhythmic episodes, with 38 episodes (46.3%) receiving ATP only, 34 (41.5%) receiving shock only, and 10 (12.2%) receiving both ATP and shock. Among 27 discrete, spontaneous episodes (n=17 patients) treated with shock, all 27 (100%) were successfully converted to normal sinus rhythm. In addition, four patients received shock therapy for 17 episodes during VT storm, with 16 being successful. In one episode, the outcome could not be determined due to device storage limitations, but the patient was hospitalized at which point the arrhythmia was resolved. The

KM-estimated rate of first appropriate therapy (ATP and/or shock) was 9.2% at 3 years (Figure 1).

Characterization of ATP

There were 48 (n=14 patients) monomorphic VT episodes that received appropriate ATP therapy, with 37 episodes (n=9 patients) being successfully terminated by ATP for a success rate of 77.1%. Antitachycardia pacing was nominally "off" in the device, and the proportion of patients who were reported to have ATP programmed "on" significantly increased from 66.8% at PHD to 81.2% at last study visit (P<0.0001; Supplemental Table 2). At 2 years, ATP was programmed "off" in 2.8% of patients due to pacing sensation during in-clinic electrical testing; however, no patient that received successful ambulatory ATP subsequently had it programmed "off".

Safety

A total of 31 major complications causally related to the EV ICD system- and/or procedure occurred in 29 (9.2%) patients, six (n=6 patients) of which occurred more than 6 months post-implant (Supplemental Table 3). The most common were lead dislodgement (10 events; n=9 patients, 2.8%), postoperative wound or implant site infection (n=8, 2.5%), and device inappropriate shock delivery resulting in hospitalization (n=3, 0.9%) or system revision (n=1, 0.3%) (Table 2). Rate of freedom from major system- and/or procedure-related complications was 91.9% and 89.0% at 1 and 3 years, respectively (Figure 2). Three lead fractures occurred at 7-, 11-, and 34-months post-implant. All 3 were discovered through high voltage lead impedance alerts. No inappropriate shocks occurred as a result of the fractures (See Supplemental Results). No major intraprocedural complications, nor any unique major complications related to the EV ICD system or procedure were reported. No deaths occurred from arrhythmia as a result of ineffective device therapy, and none occurred that had a causal relationship with the EV ICD

system or procedure. In sudden cardiac death cases with lack of information (e.g., no device data, no autopsy) available for adjudication, events were conservatively adjudicated as possibly related to the system. Per this definition, two deaths were adjudicated as possibly related to the system (Supplemental Results; Supplemental Table 4).

System revisions

A system revision was required in 24 patients (7.6%) due to a major complication related to the EV ICD system or procedure, 19 of which occurred within 1 year of implant (Supplemental Results). Reasons for the 24 system revisions included: lead dislodgement (n=9), wound or implant site infection (n=7), lead fracture (n=3), hemorrhage (n=1), inappropriate shock (n=1), implant site discomfort (n=1), device placement issue (n=1), and device software-hardware interaction (n=1). Of the 24 revisions, six involved a repositioning of the lead (n=3) or generator (n=3), while 18 were a removal of the lead only (n=7), generator only (n=1), or of the entire system (n=10). The lead or generator was replaced with a new EV ICD lead or generator in all eight cases where only one or the other was removed. In patients where the entire system was removed, two were reimplanted with a new EV ICD system, one with a transvenous system, and in seven cases device reimplant status was not available due to patient exiting study before possible reimplant. More information on all revisions and lead removal post-implant can be found in the supplement.

Infection

A system or procedure-related infection was reported in 15 patients through last follow-up, 13 occurring within 2 months of implant (median occurrence: 0.9 months post-implant; min: 0.3, max: 24.2 months). Eight infections were classified as a major complication, three as a minor complication, and four as observations. The infections were related to either the lateral pocket

(n=9), subxiphoid incision (n=4), or both (n=2). Antibiotics, with or without wound care, were used to treat all 15 infections; six also required system removal and one also required device repositioning. All 15 patients recovered without any lasting effects. There were no reports of system- or procedure-related mediastinitis, sepsis, or endocarditis, and no deaths from infection.

Inappropriate shock

Inappropriate shocks were received by 46 patients for 135 episodes through all of follow-up. The KM-estimated first inappropriate shock rate was 9.8% at 1 year and 17.5% at 3 years, with the majority of first inappropriate shocks observed within 6 months of implant (Figure 3). The most common causes of inappropriate shock were P-wave oversensing (69 episodes), myopotential noise (35 episodes), and atrial fibrillation or atrial flutter (14 episodes) (Supplemental Table 5). Inappropriate shocks were managed without system revision in 41 of 46 patients, of whom 30/41 (73.2%) patients did not receive a subsequent inappropriate shock post-device interrogation through final follow-up (mean 19.0 ± 11.7 months follow-up post-interrogation). Five patients had a system revision following inappropriate shock (lead replaced), four where lead dislodgement was the primary cause and one due to chronic myopotential oversensing.

Electrical performance

The R-wave amplitude, measured at Ring 1-Ring 2 vector in a sitting position, increased after discharge but was steady over time with mean measures of 2.5 ± 1.6, 3.0 ± 1.7, and 2.9 ± 1.8 millivolts at PHD, 0.5, and 3 years, respectively (Figure 4A). For those that completed capture testing, mean pacing capture threshold values were 5.0 ± 2.0, 5.5 ± 2.0, and 5.9 ± 2.2 volts at PHD, 0.5, and 3 years, respectively, for Ring 1- Coil 2 vector (Figure 4B). Mean pacing impedance from Ring 1-Ring 2 vector increased from PHD (339.6 ± 137.7 Ohms) to 0.5 years

follow-up (512.1 ± 146.8 Ohms) but leveled off (515.8 ± 124.1 Ohms at 3 years) (Figure 4C). These measures remained consistent across different vectors.

Discussion

In the initial report of this prospective, single arm, multicenter, global study, the EV ICD system displayed defibrillation efficacy and a favorable safety profile at 6 months.[11] We now report continued safety and effective termination of spontaneous ventricular episodes through 3 years. There were no major intraprocedural complications, underscoring the effectiveness of device-specific implant training and purpose-built implant tools. The majority of major system- or procedure-related complications occurred within the first 6 months. Furthermore, no major complications occurred with the EV ICD that have not been seen in other types of ICD systems. With a lead placed in close proximity to the myocardium, ATP and pause prevention pacing was successfully delivered without the need for an intravascular lead. Antitachycardia pacing was successful in 77% of episodes in which it was utilized, and two patients received pause prevention pacing for appropriately detected episodes of prolonged asystole (See Supplemental Results). The sustained effectiveness and stable electrical parameters during prolonged follow-up suggest that therapy delivery is successful across time-dependent factors such as body position, time of day, or physiologic changes to the patient.

ATP performance

As with transvenous ICDs, the EV ICD can provide ATP, post-shock pacing, and defibrillation therapies with one device. The EV ICD delivered a 77% ATP success rate, in line with the 52-80% success rate reported for transvenous systems.[16,17] Antitachycardia pacing is not available with the S-ICD, but a two-device S-ICD and leadless pacemaker communicating system is under

investigation and recently reported a 61.3% ATP success rate at 6 months.[16-18] However, the cumulative risk associated with implantation and long-term management of two devices is presently unknown.

Availability of ATP therapy with the EV ICD system prevented shocks in nearly half of spontaneous VT/VF episodes. This result highlights a major benefit of ATP, which is to avoid potentially unnecessary shocks that are painful, reduce patient quality of life, and increase morbidity.[19] While ATP has been shown to effectively treat VT, ATP is not as effective at terminating VF.[17,20] Unsuccessful ATP can result in delaying shock therapy or acceleration of ventricular arrhythmias into faster VT or VF. An ATP-induced acceleration rate of 2-5% has been reported for transvenous systems, but there is no evidence to suggest the rate is different with EV ICD.[17,21] However, further evaluation of these events with the EV ICD system is needed.

A small percentage of Pivotal patients (2.8%) had ATP programmed "off" at 2 years due to sensation related to in-office electrical testing, and no patients who received successful ATP for spontaneous episodes had ATP subsequently programmed "off". In addition, the proportion of patients with ATP programmed "on" increased over the course of the study. Taken together, these results illustrate that in-office testing may not reflect the ambulatory experience with ATP and, as a whole, ATP therapy from an EV ICD is well-tolerated and accepted by patients as a measure to terminate ventricular episodes and potentially reduce shock burden.

Safety

The EV ICD system exhibited a 92.6% rate of freedom from major system- or procedure related-complications at 6 months and 89.0% rate at 3 years. This rate is on par with both the 88.7% 3-year rate reported for the S-ICD in the EFFORTLESS study and rates reported for transvenous systems (90.9% through 16 months), although a direct comparison would be needed to

definitively determine how the different ICDs compare with one another in terms of safety.[22,23] There were 24 system- or procedure-related major complications that resulted in a system revision, 19 of which occurred within one year of implant. Despite the EV ICD lead being placed close to the heart, there were no cardiac injuries during implant or through follow-up. Lead dislodgements (10 events; n=9 patients, 2.8%) were the most frequent major complication in the Pivotal study; all occurred within 6 months of implant and were attributed to suboptimal suturing or improper lead placement. As a result, implant training emphasizes a minimum of three sutures to fixate the lead and tunneling left of the sternal midline for proper lead placement. For context, acute lead dislodgement is reported to be 2-8% over the long-term with transvenous systems (1.3% pre-discharge rate), but is less frequent with subcutaneous ICDs (< 1%).[8,24,25] Lead fractures were noted in 3 patients (attributed to suboptimal lead placement in two), and have been addressed with training improvements and manufacturing enhancements. Future evaluation of real-world EV ICD performance will be needed to assess the effect of these refinements through the life of the device. Pivotal study participants had the opportunity to continue follow-up by enrolling in the post-approval Enlighten study, and so extended clinical data will be available for a significant proportion of Pivotal patients for the life of the device.

Fifteen infections occurred that were related to the EV ICD system or procedure (two > 6 months post-implant), eight of which were classified as a major complication. A majority were successfully treated conservatively with antibiotics and wound care only, while seven (2.2%) also required a system revision. All infections resolved following treatment, and importantly, no potentially life-threatening infections including mediastinitis, sepsis, or endocarditis related to the system or procedure occurred. When lead removal was necessary it was accomplished using simple traction in most cases or with commonly available lead extraction tools (See

Supplemental Results). Most lead removals in this study occurred within 1 year of implant; continued observation of chronic EV ICD lead extraction is needed.

Inappropriate shocks

The 1-year and 3-year inappropriate shock rates for the EV ICD were 9.8% and 17.5%, respectively. By comparison, the 1-year inappropriate shock rate for the S-ICD was 13.1% in its investigational device exemption (IDE) trial.[7] More recently, S-ICD has reported improved 1-year inappropriate shock rates of 3.1% in the UNTOUCHED study, though secondary prevention patients were excluded, and 6.7% in a post-approval study.[26,27] P-wave oversensing was the most common reason for inappropriate shock with the EV ICD (51% of episodes) due to lead placement near the right atrial appendage, which is not a main culprit of inappropriate shock with other ICDs. The current commercially available Aurora EV-ICD™ system now includes a novel algorithm (Smart Sense) aimed at reducing P-wave oversensing, which was not available at any point during the Pivotal study. In a retrospective simulation of EV ICD Pivotal study episodes, Swerdlow *et al* showed the Smart Sense algorithm reduced the total inappropriate shock rate by 29% with no impact on sensitivity.[28] Based on these findings, the results presented herein, particularly in regards to inappropriate shock, may not be representative of the real-world experience with the Aurora EV-ICD system.

Incorporation of novel algorithms is one method aimed at lowering inappropriate shock rates. They can also be mitigated via patient-tailored programming and refinement of surgical technique and lead positioning with added implanter experience. Because of these improvements, inappropriate shocks tend to decrease with time, as has been observed with transvenous and subcutaneous devices.[29,30] In the present study, more than 70% of patients who received a first inappropriate shock did not experience a subsequent inappropriate shock after

device interrogation, suggesting an opportunity for programming optimization. The first inappropriate shock rate slowed after 6 months, with a majority of first inappropriate shocks occurring during the first year post-implant. Device programming changes used to address inappropriate shock included change in sensing vector, extending the time to detection, and increasing the sensing amplitude; other strategies used to manage inappropriate shock included medication adjustments or device revision.

Substernal lead performance

As previously reported, substernal lead placement resulted in effective defibrillation that remained stable over time in patients who completed chronic defibrillation threshold testing.[11] At implant, defibrillation testing was successful at 30 J or less in 98.7% of patients and was successful in all patients who underwent testing at 6 months. Additionally, shocks were successful for 100% (27/27) of discrete, spontaneous episodes in 17 patients; however, assessment of shock success for ambulatory discrete episodes will be needed in a larger cohort of patients. The shock energies required for successful defibrillation with EV ICD are in accordance with defibrillation thresholds used in transvenous systems and lower than what has been required for the S-ICD.[7] Pacing and electrical performance of the EV ICD were steady over time, demonstrating the stability of leads placed substernally. R-wave amplitudes increased slightly after PHD but then stabilized through 3-year follow-up and were similarly stable regardless of body positioning or vector configuration. Pacing capture thresholds and impedance were stable after discharge, but pacing thresholds were higher than what is expected with a transvenous system that is implanted within the heart. Among those who had post-shock or pause prevention pacing programmed ‘on” and required such therapy, three received successful pacing (See Supplemental Results).

Patient experience

In addition to effective therapy, the EV ICD system has demonstrated positive patient experience in the Pivotal study. The lower energy needed for defibrillation with EV ICD allows for a projected battery longevity that is comparable to transvenous systems; Knight and colleagues previously showed, via modeling, that the extended battery life could reduce the number of device replacements and long-term cost for the patient.[12] However, pacing thresholds for EV ICD are higher than what is typical of transvenous systems, which could negatively impact battery longevity in patients that frequently receive pacing therapy. The EV ICD Pivotal study previously reported improvements in patient physical quality of life from baseline to 6 months.[31] Specifically, Sears *et al* found favorable quality of life results for patients with the EV ICD system compared with previous studies of other systems using the same metrics (Florida Patient Acceptance Survey Score).[31] Real-world experience will be needed to further characterize the holistic patient experience with EV ICD to determine if improved patient quality of life, in addition to clinical outcomes, persist through the lifetime of the device.

Limitations

This study must be considered within the context of its limitations. The study was non-randomized and single arm, with no comparator to subcutaneous or transvenous systems. Procedures were performed at expert centers in a clinical trial environment with a prespecified follow-up and testing protocol. As the population in this study was younger than those who might typically receive an ICD, more data will be needed to evaluate the EV ICD performance in older patients with more comorbidities. These results display multi-year efficacy and safety, but it will be critical to assess the EV ICD system over the lifetime of the device. This includes a more robust assessment of lead removal, device longevity, long-term complications, therapy

rates, and lead stability over chronic (> 4 years) timeframes. As previously discussed, the EV ICD system implanted during the Pivotal study differs from the one currently being implanted due to the addition of an inappropriate shock reducing algorithm (Smart Sense) and manufacturing enhancements. Additionally, implanter training has since been updated to focus on avoiding dislodgement and minimize P-waves, so these results, inappropriate shocks in particular, may not be applicable to current experience. The Enlighten Study, a global, prospective registry, will evaluate the real-world safety and performance of the Aurora EV-ICD system with Smart Sense algorithm over the lifetime of the device (ClinicalTrials.gov ID: NCT06048731).

Conclusions

In this prospective global study, the EV ICD system terminated spontaneous ventricular arrhythmias with a high rate of ATP and defibrillation therapy success, and a low major complication rate through long-term follow-up. The EV ICD system, with substernal lead placement, can provide ATP and low-energy defibrillation in a single device, while outside the vasculature.

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Supplemental Materials

Supplemental Methods

Supplemental Results

Tables S1-S5

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Table 1. Baseline Patient Characteristics.

	Patients with Implantation Attempted (N = 316)
Age (mean years ± SD)	**53.8±13.1**
Gender (N, %)	
Female	80 (25.3%)
ICD Indication (N, %)	
Primary Prevention	258 (81.6%)
Secondary prevention	57 (18.0%)
Unclassified	1 (0.3%)
NYHA Class (N, %)	
I	75 (23.7%)
II	184 (58.2%)
III	23 (7.3%)
IV	0 (0.0%)
Not available	34 (10.8%)
BMI (mean kg/m2 ± SD)	**28.0±5.6**
LV Ejection Fraction (mean % ± SD)	**38.9±15.4**
LVEF >35% (N, %)	115 (36.4%)
Cardiomyopathy (N, %)	**266 (84.2%)**
Ischemic	127 (40.2%)
Non-ischemic	103 (32.6%)
Hypertrophic	41 (13.0%)
Primary/idiopathic electrical disease (N, %)	**24 (7.6%)**
Stroke and stroke-related events (N, %)	**24 (7.6%)**
Spontaneous Arrhythmias (N, %)	
Atrial fibrillation	45 (14.2%)
Ventricular arrhythmias	136 (43.0%)
Other Medical History (N, %)	
Arrhythmogenic RV dysplasia/cardiomyopathy, 1 or more risk factors for SCD	5 (1.6%)
Chronic obstructive pulmonary disease	13 (4.1%)
Diabetes	66 (20.9%)
Renal dysfunction	31 (9.8%)
Medication Type (N, %)	
Beta Blocker Agents (Excl. Sotalol)	243 (76.9%)
Antiarrhythmic Drugs (Class I Or III, Inc. Sotalol)	20 (6.3%)
ACE Inhibitors/ARBs/ARNIs	204 (64.6%)
Mineralocorticoid Receptor Antagonists	126 (39.9%)

Race (N, %)	
Asian	7 (2.2%)
Black or African American	16 (5.1%)
Hispanic or Latino	7 (2.2%)
White	87 (27.5%)
Data not available due to local requirements	197 (62.3%)

Data are reported as mean ± SD
ACE: angiotensin-converting enzyme, ARB: angiotensin II receptor blockers, ARNI: angiotensin receptor-neprilysin inhibitor, BMI: body mass index, ICD: implantable cardioverter-defibrillator, LVEF: left ventricular ejection fraction, NYHA: New York Heart Association, RV: right ventricular, SCD: sudden cardiac death, US: United States

Table 2. Summary of EV ICD System- or Procedure-Related Major Complications.

Major complication	Number of events (N, %*) (N = 316)
Lead dislodgement	10 (9, 2.8%)
Postoperative wound infection	5 (5, 1.6%)
Device inappropriate shock delivery	4 (4, 1.3%)
Lead fracture	3 (3, 0.9%)
Implant site infection	3 (3, 0.9%)
Device software-hardware interaction	1 (1, 0.3%)
Device placement issue	1 (1, 0.3%)
Incision site impaired healing	1 (1, 0.3%)
Implant site pain	1 (1, 0.3%)
Medical device site discomfort	1 (1, 0.3%)
Total	**31 (29, 9.2%)**

*****Percentages computed by dividing the number of patients with an event by the total number with an implant attempt (mean follow-up 29.0 ± 10.6 months)

Figure Legends

Figure 1. Cumulative Rate of First Appropriate Therapy through 3 Years

Kaplan-Meier estimated time to first appropriate shock, ATP, or any therapy through 3 years. The number at risk are represented below in red (any therapy), green (ATP) and black (shock). The 6-month timeframe is shaded in gray. ATP: antitachycardia pacing.

Figure 2. Freedom from System- and/or Procedure-Related Complications through 3 Years

Kaplan-Meier estimated freedom from system- and/or procedure-related major complications through 3 years post-implant. The number at risk are represented in blue; 95% confidence intervals are given at 6-month intervals. The 6-month timeframe is shaded in gray.

Figure 3. Cumulative Rate of First Inappropriate Therapy through 3 Years

Kaplan-Meier estimated time to first inappropriate shock or any therapy through 3 years. The number at risk are represented below for any therapy (red) and shock (black). The 6-month timeframe is shaded in gray.

Figure 4. EV ICD Electrical Performance through 3 Years

The mean R-wave amplitude in millivolts (mV) **(A)**, mean pacing capture threshold in volts (V) **(B)**, and mean impedance in Ohms **(C)** are depicted at PHD, 0.5, 1, 2, and 3 years follow-up with standard deviation. The amplitude was recorded using Ring 1 to Ring 2 vector in an upright, sitting position; pacing threshold was recorded using Ring 1 to Coil 2 vector. In **(B)**, measurements were taken for those with successful capture at time of measurement; the mean

Ring 1 to Coil 2 pulse widths at PHD, 0.5, 1, 2 and 3 years were 3.0 ± 2.0, 3.4 ± 2.3, 3.3 ± 2.1, 3.2 ± 2.1, and 4.6 ± 2.8 milliseconds, respectively. Number of patients measured at each timepoint are given below in blue. PHD: pre-hospital discharge.