Real-world performance of a fully automatic antitachycardia pacing algorithm

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Funding Acknowledgements: Type of funding sources: Private company. Main funding source(s): Medtronic, Inc.

Background: Antitachycardia pacing (ATP) found in most implantable cardioverter defibrillators (ICDs) is an important therapy for painless termination of ventricular tachycardias (VT). In ICDs programmed to guideline-recommended detection and therapy settings typical ATP success rates are 50-70%. The first closed-loop, automated ATP (AATP) algorithm, introduced in 2021, applies an S1 train derived from the detected VT, followed by an S2 derived initially from a refractory period estimator and then adjusted using analysis of the post-pacing interval if ATP fails. The termination efficacy of AATP in the real-world population is unknown.

Purpose: To assess the effectiveness AATP in a large real-world population.

Methods: A database of de-identified ICD transmissions from subjects in the United States, Australia, Canada, and New Zealand was queried for AATP treated episodes. ICDs were randomly sampled, biased toward ICDs with multiple treated VT episodes. For rhythms classified as monomorphic ventricular tachycardia, each AATP pulse train was reviewed for: rhythm at delivery, effect of ATP, and any non-capturing pulses. Acceleration was defined as a post-ATP decrease in MVT cycle length (VTCL) of at least 10% and at least 30ms. Acceleration to polymorphic VT or ventricular fibrillation (PVT/VF) was assessed. Rates of termination and acceleration were calculated for all MVT and dichotomized using a 320ms VTCL cutoff. The method of generalized estimating equations (GEE) was used to correct event rates for multiple episodes from a single patient.

Results: There were 2281 episodes of MVT in 340 patients; 63% of patients had 2 or more episodes. There were 724 episodes with initial VTCL <320ms and 1557 episodes with VTCL ≥320ms. The rate of termination of MVT by AATP was 78% for all VTCL [95% CI: 74%-81%]. In 300 patients (88%) AATP terminated at least one MVT. For MVT with VTCL ≥320ms the termination rate was 80% [95% CI: 75%-83%] and for VTCL <320ms the termination rate was 75% [95% CI: 69%-80%]. The rate of acceleration was 3.6% [95% CI: 2.7%-4.9%], with a 0.8% rate of acceleration to PVT/VF [95% CI: 0.4%-1.8%]. Acceleration led to shock therapy in 63% of accelerated episodes. All MVT accelerated to PVT/VF either spontaneously terminated (4/14) or were successfully converted by a single shock therapy (10/14). All accelerations that remained MVT were successfully treated by the device with either subsequent ATP (35%) or shock therapy (61%), or spontaneously terminated (4%).

Conclusion: In this large, real-world cohort analysis, automated ATP’s termination rate exceeded the typical success rate of burst ATP, particularly for MVT <320ms. Acceleration to PVT/VF was low and effective first-shock defibrillation was consistent. Subsequent ATP for accelerated MVT had incremental benefit, leading to successful termination one-third of the time. Additional data are currently being prospectively collected in a separate post-approval study.