DUAL-CHAMBER LEADLESS PACEMAKER ENABLES ROBUST ATRIOVENTRICULAR SYNCHRONY IN VARIOUS POSTURES AND PACING CONFIGURATIONS

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**Background:** Dual-chamber leadless (DDD) indicated patients require atrioventricular (AV) synchronous pacing involving beat-by-beat, wireless communication between devices. Implant-to-implant (i2i™) communication enables true AV synchrony. At each paced or sensed event, one leadless pacemaker (LP) communicates wirelessly with the other. Changes in posture could affect orientation of the LPs and thereby potentially impact i2i communication.

**Objective:** Demonstrate the performance of a novel, beat-by-beat i2i communication modality for synchronous, dual-chamber pacing using 2 implanted LPs in the right atrium (RA) and right ventricle (RV) while subjects assume various postures.

**Methods:** A preclinical feasibility study was performed with ovine, and AV synchrony was evaluated in various postures and pacing configurations. RA and RV Avera™ DR LPs (Abbott, Abbott Park, IL) were implanted in 7 subjects: 4 with AV block and 3 without AV block. Inclusion of AV block subjects allowed for normal paced and sensed AV delays when delivering ventricular pacing (VP). After at least 1 month post-implant, each subject received pacing in 2 configurations: either AP (atrial pace)-VP and AS (atrial sense)-VP or AP-VS (ventricular sense) and AS-VS. Diagnostic data was analyzed following 5-min periods of on-demand testing for which each ovine assumed a series of postures (left and right laterals, supine, and standing). i2i communication success rate was used as a surrogate metric to approximate AV synchrony.

**Results:** The overall i2i communication success rate was 98.6±1.6%. The i2i success rates by posture were equivalent (P=0.19): 98.9±1.7% (left lateral), 99.9±0.0% (right lateral), 98.1±4.2% (supine), and 97.3±4.2% (standing). Heart rate was on average 98±21bpm (range: 30-170). The i2i success rates by pacing configuration were equivalent (P=0.76): 98.4±3.4% (AP-VP), 98.8±1.8% (AP-VS), 99.4±0.7% (AS-VP), and 97.9±2.7% (AS-VS). Of all instances when i2i communication was lost, 99.4% were shorter than 6 sec—yet ventricular pacing was always maintained, if needed, at the current rate. Postural changes and pacing configurations did not significantly impact i2i success rates.

**Conclusion:** True dual-chamber (DDD) leadless pacing is feasible whereby AV synchronous i2i communication is maintained beat-by-beat.

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Background: Sustained ventricular arrhythmias (VT) are common in patients receiving continuous flow left ventricular assist devices (LVAD). The impact of early (<30 days post-LVAD) vs. late VT (>30 days post-LVAD) on clinical outcomes remains unclear.

Objective: We evaluated outcomes associated with early and late VT following LVAD implantation using metaanalytic techniques.

Methods: Studies assessing the impact of VT (defined as sustained VT >30 sec or requiring ICD therapy) on survival and right ventricular (RV) failure after LVAD implantation were included. Mantel-Haenszel random effects model was used to compute overall effects. Study heterogeneity was evaluated using the I² index.

Results: 12 observational studies including 2389 LVAD patients (age 56 years) assessed the impact of early VT, late VT, and any VT. 36 % were implanted for destination therapy, 53 % had ischemic cardiomyopathy and 71% had an ICD. Mean follow-up was 19.4 months of LVAD support. Early VT [OR 1.88, 95% CI 1.36-2.58, p = 0.0001, Figure 1A] and any VT [OR 2.09, 95% CI 0.97-4.51, p=0.06, Figure 1B] were associated with worsening survival, whereas late VT [OR 0.79, 95% CI 0.44 - 1.41, p=0.43] was not. Presence of late VT [OR 1.99, 95% CI 1.05 - 3.77, p=0.03, Figure 2] or any VT [OR 1.99, 95% CI 1.05 - 3.77, p=0.03] were associated with RV failure.

Conclusion: In LVAD patients, VT was associated with increased mortality and RV failure. Early VT appears to have a strong association with mortality whereas late VT was associated with development of RV Failure.

Magnetic Field Interactions Between Contemporary Electronic Consumer Products and Cardiac Implantable Electronic Devices

Background: Evolving electronic technologies such as cell phones, smartwatches, and earphones may contain magnets to facilitate inductive fast charging and other functions. The interaction between such products and the magnet mode features of cardiac implantable electronic devices (CIED) is unclear.

Objective: Characterize the maximum static magnetic fields of common inductive fast charging products (IFC-P) and assess their interaction with CIEDs from Medtronic and Boston Scientific.

Methods: A Gauss (G) meter measured the maximum static magnetic field for each IFC-P. To test for magnetic interaction (rate change or auditory beep), an IFC-P was positioned over a CIED that was immersed in a standardized torso simulator filled with physiologic saline together with its leads; interactions were recorded at the surface (0 cm) and at distances of 0.5, 1.0, and 1.5 cm or greater until no magnet interaction was observed.

Results: The iPhone 12 Pro produced nearly 3x the static magnetic field measured at the surface of the iPhone XR, and almost 2x that of the Galaxy S6; the highest maximum static magnetic field was 1320 G from the Apple Watch Series 6. Magnetic interactions are shown in the table; all IFC-P devices produced a magnet interaction at the surface but only the Apple Watch Series 6 produced an interaction at 1.5 cm and this response was intermittent and brief. The Apple Watch Series 6 and 2nd generation AirPods required very precise placement over the CIED to produce a magnet response despite their higher measured maximum magnetic fields.

Conclusion: While the iPhone 12, Apple Watch Series 6, and 2nd generation AirPods may cause magnet interactions with CIEDs, interactions are unlikely if these products conservatively are not within 15 cm (6 inches) of an implanted pacemaker or defibrillator. This is in accordance with industry standards and recommendations as the magnetic field strength reduces dramatically with increasing distance.