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Novel Wirelessly Powered Epicardial Microchip Pacemaker

Author Block: HONGMING LYU, Rice Univ, Houston, TX; Brian D Greet, David A. Burkland, Mathews M. John, Anand V. Ganapathy, Texas Heart Inst/Baylor Coll of Med, Houston, TX; Yuxiang Sun, Rice Univ, HOUSTON, TX; Farshad R Shabari, UCSD, San Diego, CA; Joe Cavallaro, Behnaam Aazhang, Aydin Babakhani, Rice Univ, Houston, TX; Mehdi Razavi, Texas Heart Inst/Baylor Coll of Med, Houston, TX

Abstract:
Novel Wirelessly Powered Epicardial Microchip Pacemaker
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Texas Heart Institute, Baylor College of Medicine, and Rice University
Background
New advancements in pacemaker technology have pushed the field from traditional pacemakers to the development of leadless pacemakers to mitigate risks. While current leadless pacemakers have reduced the risks associated with leads, they have not been able to substantially reduce the size and weight of these pacemakers because of the on-board battery. Because of this form factor, these devices are limited in their ability to pace from multiple chambers.
Objective
To perform a proof of concept study of a novel radiofrequency(RF) powered epicardially placed microchip to capture ventricular myocardium in an acute ovine model.
Method
The device consisted of a 5mmx7mm printed circuit board (PCB) with an on-board antenna. The PCB was assembled with a microchip (0.2mmx1mm) capable of being wirelessly powered at 160MHz and an external 10μF capacitor. A transmitter placed approximately 6cm above the PCB, wirelessly transmitted RF to power the device. The received power charges the external capacitor and a low power circuitry on the silicon microchip detects the voltage and instantly discharges the energy when the detected

voltage is higher than a threshold. The output frequency was controlled by modulation of the power-transmitting signal. The assembled circuit was capable of delivering a 2.0V pulse at a pulse width of 20ms. This output was sourced to the heart by means of straight suture needles soldered onto the PCB. The circuit was implanted epicardially in an open-chest acute ovine model. EP Labsystem Pro (Boston Scientific, Marlborough, MA) was used to collect data from a decapolar catheter placed endocardially on the RV.

Result

We were able to successfully capture the epicardium and pace the heart.

Conclusion

This proof of concept study showed that our wirelessly powered microchip can pace the ventricular myocardium. This study shows the potential for this type of device and encourages further study into wirelessly powered pacemakers.

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Author Disclosure Information:

H. Lyu: None. **B.D. Greet:** None. **D.A. Burkland:** None. **M.M. John:** None. **A.V. Ganapathy:** None. **Y. Sun:** None. **F.R. Shabari:** None. **J. Cavallaro:** None. **B. Aazhang:** None. **A. Babakhani:** None. **M. Razavi:** None.

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