Cardiovascular Transcutaneous Pacemaker

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Technology description

The University of Iowa researchers have identified an innovative method to improve cardiovascular conditioning by delivering episodic heart rate accelerationviapacing. The new method induces favorable remodeling of the cardiac muscle to improve function and resistance to injury in the setting of heart disease. The method works by generating a first series of electrical signals to the heart. Simultaneously, the cardiac response is analyzed by a monitoring device that determines whether a physiological parameter has met a physiological threshold based on the retrieved data. If the physiological threshold has not been met, the monitoring device can modify the first series of electrical signals to an acceptable level. When tested in animals, the method induces significant upregulation of protective molecular pathways similar to those produced by exercise. Treated hearts exhibit smaller areas of injury and less death of heart cells following stress. Treatment initiated after an injury has already occurred appears to reduce the degree of scarring that forms. The approach has already been tried in humans with severe heart failure and it has been found to be well-tolerated with trends toward improved symptoms and increased exercise tolerance.

Background Information

Researchers at the University of Iowa have created a novel method of pacing the heart in an "exercise-inspired" pattern to improve its function and stress resistance. The approach may be particularly beneficial in treating heart failure. Heart failure accounts for more than 700,000 U.S. hospital admissions each year. Roughly 50% of patients who develop heart failure die within five years of diagnosis. Identifying new treatments for heart failure is a top priority for researchers in medicine. Biventricular pacing is among the most successful treatments for heart failure in select patients, indicating the power of cardiac pacing to beneficially influence cardiac function. However, biventricular pacing requires the costly implantation of specialized hardware and is only applicable to a narrow subset of patients. The University of Iowa's technology could allow almost any patient with heart failure or other heart disease to receive beneficial cardiovascular conditioning using simple, standard pacing devices – including those that patients already have implanted - or can even be applied by temporary electrodes placed through an IV or other approach. The temporary approaches could be used in-hospital to prepare patients with heart disease for surgeries or other stressful procedures. Automation of the approach would extend its use to ambulatory patients.

Technology Summary

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Advantages

The University of Iowa researchers have developed a new method to deliver cardiovascular conditioning. It can be implemented on standard pacing devices, even those already implanted, as well as by temporary pacing methods. It can thus be implemented quickly and relatively inexpensively for a broad range of heart conditions. The approach may be particularly appealing to patients and clinicians as the "exercise-inspired" basis for cardiovascular conditioning by heart rate acceleration is easily understood and accepted. This method can improve heart failure outcomes, reduce heart injury during surgery, coronary angioplasty, or other procedures, improve exercise tolerance and reduce angina pain in people with heart disease.

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