Researchers to develop new method, device for controlling blood pressure levels automatically

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University of Texas at Arlington researchers are developing a new method and device for controlling blood pressure levels in cardiac care environments that use targeted electrical stimulation rather than drugs.

The National Institutes of Health has awarded Associate Professor Young-Tae Kim and Professor Khosrow Behbehani, both from the UTA Department of Bioengineering, and Muthu Wijesundara, division head for the biomedical division at the UTA Research Institute, a $440,670 grant for continued research of a "Closed-Loop Blood Pressure Control by Neural Stimulation for Cardiac Care Environment." In this context, having a "closed loop" translates into automatically maintaining blood pressure levels.

Blood pressure modulation in a cardiac care environment such as in hypertensive emergencies have seen significant improvements due to the availability of antihypertensive drugs. Still, patients suffer varying side effects of these drugs including: fatigue, severe headaches, hypotension, dizziness, respiratory difficulty and edema. Everyone responds differently to these drugs and doctors are only supplied with a narrow acceptable range for dosages of antihypertensive drugs for a patient. However, doctors must aggressively reduce blood pressure during a hypertensive crisis, without overshooting and causing dangerously low blood pressure.

The project has two major goals.

The first goal is to establish a refined process of stimulation to the sciatic nerve or its branches for optimally controlling blood pressure by fine-tuning the electrical stimulation parameters. To do this, a series of tests will produce data indicating the most effective and precise methods for electrically controlling blood pressure. This will develop a useful treatment strategy without the use of drug therapy.

"In order to safely and precisely modulate blood pressure for patients during a perioperative cardiac procedure or hypertensive emergency, we have developed the implantable/removable Flex µCEA, or Flexible Micro-Channel Electrode Array," Kim said. "The Flex µCEA is an interface allowing for electric stimulation for neuromodulation at specific nerves to reliably control the neuronal activities that reduce blood pressure while minimizing unwanted side effects."

The second goal is to develop a closed-loop system which can automatically control blood pressure. This system will use real-time blood pressure measurements from an implantable catheter within the blood vessels to respond instantly to changes in blood pressure and keep the blood pressure within a desired range. The system would ensure less guess work of whether or not and at what level a patient will get side effects with antihypertensive drugs.

"This is an exciting project which we hope will lead to further developments in the field of using nerve stimulation as a therapy to modulate organ system function; not just for hypertension control, but a much wider range of conditions such as diabetes, sleep apnea, chronic pain and chronic obstructive pulmonary disorders," Wijesundara said.

The closed-loop system will allow patients to feel assured that they are receiving proper treatment for their level of cardiac illness without unknown side effects. An added benefit is that the patient incurs less expense because there are no drug-induced side-effects to rectify.

"It's gratifying to see that active collaborations between UTA bioengineering and UTARI continue to bear success" said Michael Cho, chair of the UTA Department of Bioengineering. "We all look forward to even more collaborative efforts that maximize expertise and research interests."

Kim's research interests are in early cancer detection, brain tumor migration, neuroprosthetics, and bioelectronic medicine. He has partnered with UT Southwestern Medical Center and many colleagues, including Bioengineering Professor Cheng-Jen Chuong and Electrical Engineering Associate Professor Samir Iqbal.

Behbehani is the former dean of the College of Engineering. His research interests are focused on sleep apnea diagnostics and treatment devices. He is the owner of nine patents.

Wijesundara heads up the UTARI division that looks to advance technology that applies to tissue regeneration and wound healing, drug delivery, and prosthetic devices and interfaces. Most recently, he has worked on projects that designed a rehab glove that helps stroke victims, a smart glove that delivers needed medicine to an injured hand and speeds up healing, and a smart cushion designed to prevent pressure ulcers in wheelchair users.

Provided by University of Texas at Arlington

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