

Exploration into the Development of Bionic Blood Pressure Controller in Patients with Spinal Cord Injuries

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【Outline of survey】

The objective of this investigation is to develop the fundamental technology of the bionic blood pressure regulation in order to combat with severe orthostatic hypotension in patients with spinal cord injuries.

In our previous studies, we developed the bionic blood pressure control systems where we electrically stimulated the sympathetic system by feedbacking arterial pressure. In those systems we stimulate the sympathetic nerves at the celiac ganglia. Under clinical settings, however, the fact that the celiac ganglia are in the retroperitoneal space makes it difficult to use them as targets of electrical stimulation. Therefore, in this new investigation, we will develop alternative methods to easily stimulate the sympathetic nerves with spinal epidural electrodes and/or with the minimally invasive somatic input through the spinal reflex. We will then develop algorithms individualized for each stimulation strategies and optimize respective parameter values for feedback controllers. In the final year, we will evaluate the efficacy of bionic pressure controller in the orthostatic hypotension and validate newly developed technology.

【Expected results】

The bionic blood pressure controller will prevent severe orthostatic hypotension, thereby save many patients with baroreflex failure such as Shy-Drager syndrome and spinal cord injuries. Enabling passive sitting positions in those patients by improving orthostatic intolerance will have major impacts on the prognosis as well as QOL.

【References by the principal researcher】

- Li M, Zheng C, Sato T, Kawada T, Sugimachi M, Sunagawa K. Vagal nerve stimulation markedly improves long-term survival after chronic heart failure in rats. *Circulation*. 109: 120-124, 2004
- Sato T, Kawada T, Sugimachi M, Sunagawa K. Bionic technology revitalizes native baroreflex function in rats with baroreflex failure. *Circulation*. 106: 730-734, 2002

【Term of project】 FY2006 - 2010

【Budget allocation】 26,600,000 yen

【Homepage address】

<http://www.med.kyushu-u.ac.jp/cardiol/>