

# 無侵襲・無拘束循環機能計測による自律神経調節機序の解析に関する研究

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雑誌名	平成8(1996)年度 科学研究費補助金 基盤研究(B) 研究成果報告書概要
巻	1994 1996
ページ	3p.
発行年	1999-03-08
URL	<a href="http://doi.org/10.24517/00066393">http://doi.org/10.24517/00066393</a>



# 1996 Fiscal Year Final Research Report Summary

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Study on the autonomic regulation analysis of cardiovascular system using non-invasive and ambulatory system for monitoring instantaneous blood pressure and cardiac interbeat interval

Research Project

## Project/Area Number

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06454722

## Research Category

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Grant-in-Aid for Scientific Research (B)

## Allocation Type

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Single-year Grants

## Section

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一般

## Research Field

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Biomedical engineering/Biological material science

## Research Institution

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## Principal Investigator

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## Project Period (FY)

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1994 - 1996

## Keywords

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## Research Abstract

In order to analyze autonomic regulation of cardiovascular system during daily life activities, a non-invasive and ambulatory system (160x140x45mm, 700gf) has been newly designed, which can automatically monitor systolic (SBP) /mean (MBP) /diastolic pressure (DBP), pulse interval (P-P), inter-beat interval (IBI) and respiration interval (ReP) from ECG waveform on a beat-by-beat basis. Principle of blood pressure measurement is based on the volume-compensation method using vascular unloading, previously proposed by us. 6 time-series data are recorded in an IC memory card after necessary signal processings using a single-chip microcomputer with an interactive software, altogether about 700,000 beats of data being stored. After the monitoring, these stored data are reproduced, displayed on a CRT monitor, and performed necessary analyzes using a conventional personal computer. Taking physiological importance of the effect of human posture changes on the cardiovascular variables into consideration, a portable instrument for long-term ambulatory monitoring of the posture changes has been also designed in parallel with the development of the present system. This measurement is based on the fact that almost all human postures in daily life can be estimated from the angles corresponding to the gravitational direction in three portions ; chest, thigh and lower leg. The instrument (58x94x25mm, 130g) can store these angles in a CMOS RAM (2MB) using electro-magnetic inclinometers placed on the three portions, and easily be used together with the above system if required under an experimental situation.


In this study, autonomic regulatory function of the cardiovascular system was assessed by (i) baroreceptor-cardiac reflex sensitivity (BRS) obtained by computerized scanning of beat-by-beat SBP and PP (or IBI) values, (ii) transfer function calculated by power and cross spectra of SBP and IBI data, and (iii) spectral analysis of SBP and IBI data using a maximum entropy method, which were performed by a personal computer-based system. Using young (20-24 years old, male) healthy subjects, data were collected under daily life activities and categorized into 9 physical activities ; supine (rest), sitting (rest), desk work on a chair, standing, working during standing without movement, walking, up and down the stairs, and bicycle exercise. It is demonstrated that the BRS values and power spectral density of IBI data over high frequency (HF) range of 0.15-0.5 Hz were significantly reduced following the increase in the physical activities, indicating that vagal nerve activity would be depressed by the increase in the physical activities. This phenomenon was also confirmed by the gain of the transfer function at higher values of the coherence over low frequency (LF) range of 0.04-0.12 Hz and HF range. However, power spectral densities of IBI and SBP data over LF range showed no significant correlation with the physical activities, indicating that LF powers of both SBP and IBI might be modulated by the vagal and sympathetic nerve activity against the physical activities and thus not be a significant index to assess only the sympathetic activity. Through these findings, we conclude that further development of ambulatory system capable of monitoring both blood pressure and cardiac output (and thus peripheral vascular resistance) should be desired to evaluate in detail the sympathetic activity during daily life.▲ Less


## Research Products (17 results)


All Other


All Publications (17 results)


- [Publications] 沢田幸展 他: "無侵襲循環動態計測による自律神経系調節機能の解析" 生体生理工学シンポジウム論文集. 9. 235-238 (1994) ▼
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- [Publications] Yamakoshi, K.: "Volume-compensation method for non-invasive measurement of instantaneous arterial blood pressure : Principle, methodology, and some applications" Homeostasis. 36. 90-119 (1995) ▼
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**URL:**

Published: 1999-03-08