MULTIPOINT HEART RATE MEASUREMENT AND ANALYSIS FOR BLOOD PRESSURE ESTIMATION DURING SLEEP

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ABSTRACT

Cerebrovascular diseases are the fourth leading cause of death in Japan (FY2021). Hypertension, which is said to be the greatest risk factor for vascular disease, can cause arteriosclerosis, cardiac hypertrophy, stroke, myocardial infarction, etc. Therefore, early detection and treatment are important. The most effective method for early detection is to measure blood pressure on a daily basis. However, the blood pressure measurement method currently used in daily life is to press down on the upper arm with a cuff to temporarily stop arterial blood flow, making continuous measurement difficult and making it impossible to measure blood pressure changes in detail. In addition, the use of a cuff makes it time-consuming to apply, and the equipment is also large, among other problems. It is also known that nocturnal hypertension, a symptom of high blood pressure at bedtime, is closely related to cerebrovascular disease. However, blood pressure measurement at bedtime is not widely used. Therefore, a simple, unrestrained, cuff-free blood pressure measurement that can be taken on a daily basis and is not disturbed during sleep is being studied on a daily basis. Since the shortening of pulse wave propagation time is related to the rise in blood pressure, blood pressure estimation methods are attracting attention as a blood pressure measurement method. Therefore, this study aims to develop a system that can measure blood pressure while sleeping by acquiring pulse waves using multiple piezoelectric elements and estimating blood pressure based on the difference in pulse wave propagation time. In this experiment, pulse waves were measured at six points on the foot using a piezoelectric sensor. After calculating the pulse wave propagation time from the obtained pulse wave feature points, blood pressure could be estimated from the results of regression analysis. However, there was a channel in which the estimated blood pressure fluctuated little during the time when the measured blood pressure was rising significantly. The reason for this is that the time of the pulse wave feature point could not be accurately acquired, and there is a possibility of improving the accuracy of blood pressure estimation. In this study, the accuracy of blood pressure estimation was improved by improving the measurement environment and analysis method to improve the accuracy of pulse wave peak detection, which was an issue in the previous study. In addition, we evaluated the blood pressure estimated from the pulse wave without actual blood pressure measurements by using the blood pressure estimation parameters calculated using the pulse wave measurement results and actual measured blood pressure values after a long period of measurement. In the future, we would like to examine the method of detecting the correct pulse wave generation time and to verify the accuracy by conducting measurements at bedtime.