Fundamental Study on Measurement and Analysis of Biometric Data
from Abdomen and Lumbar Region for Prediction of Bowel Movement

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ABSTRACT

Among those certified as requiring nursing care in Japan, there are currently approximately 3.61 million people requiring nursing care 2 or higher who need assistance with toileting, and this number is expected to continue to increase. In a previous survey conducted by the Cabinet Office, the most difficult task was excretion care. If caregivers can directly know the timing of bowel movements, it is expected that the burden of excretion care will be greatly reduced. Currently, there are previous studies on the prediction of defecation, but they are limited to identifying the conditions before and after defecation, and none has yet been established as a defecation prediction method. The ultimate goal of this study is to construct a system to noninvasively detect bowel movements in daily life by using an unprecedented abdominal measurement method, the impedance method. As a first step, we investigated the conditions for measuring abdominal impedance, investigated the stability of impedance measurement and the effects of changes in contents, and measured and analyzed abdominal impedance to understand the intestinal contents. To examine the impedance measurement conditions, we used an ultrasound system to observe the location of the intestines from the body surface and the appearance of the abdomen while eating and drinking. As a result, it was found that there were individual differences in bowel position and that gas was generated in the stomach and intestines during eating and drinking, making it difficult to perform ultrasonic measurements. In the investigation of the stability of impedance measurement and the effects of content changes, the stability of absolute impedance values was confirmed in the forearm, where the tissue is more uniform than in the abdomen, by conducting multiple comparison experiments on different days, with the same subject and different subjects. In addition, gastric impedance measurement, which is easier to capture changes in contents than the intestine, showed that impedance increased when drinking water, and that changes in contents were reflected in impedance. In the abdominal impedance measurement before and after eating and drinking, which was conducted for abdominal impedance measurement and analysis to understand the intestines, two subjects were compared under the same subject conditions such as before and after eating and drinking, and the results showed different frequency characteristics. In the impedance measurement before and after defecation, it was found that the frequency characteristics of the impedance differed greatly depending on the measurement date, even in the same subject. Therefore, it is necessary to collect data from more subjects at different times and in different states, and to analyze a large amount of data in order to develop a bowel situation estimation model for predicting voiding using predictor variables such as gender, age, and abdominal circumference. It is believed that a bowel situation estimation model can be developed using predictive variables such as gender and age.