Department of Cell Physiology
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General Summary

Our main research interests are (1) gravitational physiology and aerospace medicine, and (2) physioepidemiological studies of health.

Research Activities

Gravitational physiology and aerospace medicine

1. Technique of electrocardiography in medaka

The medaka, or Japanese killifish, is an indigenous model vertebrate of Japan. This fish has various strains, is transparent during embryogenesis, and has been used as a research animal since the 1940s. Experiments with medaka aboard the International Space Station are now being prepared. Using the transparent medaka strain Sukesuke (SK2), we established a way to detect the heartbeat and to observe heart-rate variability with live imaging under a stereomicroscope. However, because there is no evidence that the live imaging data is coincident with electrocardiography (ECG), we are developing, in collaboration with the Japan Aerospace Exploration Agency, an ECG technique using medaka.

The medaka was placed in a damp sponge, and bipolar-lead (I, II, III, and NASA) ECGs were recorded under unanesthetized conditions with needle electrodes inserted through the skin. Wave-form analysis was performed with PowerLab data acquisition software (ADInstruments, Sydney, Australia).

In this study, we recorded clear ECG data with the NASA lead but not with leads I, II, or III. Because the data quality might depend on the needle position, we should develop a technique for precise needle insertion.

2. Research on visual stimuli and posture control

Information for maintaining body direction and movement of the body center to maintain posture are determined by visual input factors, equilibrium vestibular input factors, and somatosensory factors from the whole body (including muscle, tendon, joints, and skin). Visual information becomes the main factor in outer space because vestibular and somatosensory inputs are reduced because of low or absent gravity. The objective of this research is to analyze changes in posture induced by visual stimuli.

3. Outreach activities for aerospace medicine

Our outreach activities aim to promote public understanding of science and to provide information to the public and include publishing books and holding public talks, lectures, and discussions. Recently, public outreach has been become important in science. We have been starting outreach activities for aerospace medicine.

Results of physioepidemiological studies

Many previous studies of wellness medicine and occupational health have been performed with epidemiological methods. However, in this study physiological data (e.g., ECG) were analyzed with epidemiological methods. Mental stress and human health can be evaluated objectively using both physiological and epidemiological methods.

1. Comparison of ECGs from parents and children

The QTc interval determined from ECGs showed a significant relationship between parents and children. The QTc interval might be affected by hereditary factors.

2. Mental stress in physicians performing endoscopic procedures

The mental stress experienced by endoscopists performing endoscopic procedures was directly measured with Holter ECG monitors. Performing an endoscopic procedure causes endoscopists to experience mental stress. This stress may be severe until the endoscopist has acquired significant experience.

Publications

Toi T*[1]*, Nomura Y*[1]*, Sudoh M, Ikeda A*[1]*, Masuda T*[1]*, Iikuni H*[1]*, Asakawa N*[1]*, Ikui A*[2]*, Shigihara S*[1]*, Ikeda M*[1] *(*[1]*Nihon Univ Sch Med,* [2]*Hakuraku Clin). A case of vertigo and hearing loss induced by aero-alternobaric barotraumas (in Japanese). *Uchu Koku Kankyo Igaku* 2010; **47:** 25–31.