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Author: Mr. Guanglei Liu
Beihang University, China, liuguanglei@be.buaa.edu.cn

Dr. Zhicheng Wang
China, ahwzc@126.com
Dr. Suping Li
China, yiyi–@tom.com
Mr. Quanwei Shi
China, sqw_1985@yahoo.com.cn
Dr. Rong Yan
China, yanrongbaobao@163.com
Prof. Yuedan Wang
Peking University, China, wangyuedan@bjmu.edu.cn
Prof. Yinghui Li
China Astronaut Research and Training Center, China, yinghuidd@vip.sina.com
Prof. Yanqiang Bai
Astronaut Center of China, China, baiyanqiang@163.com
Prof. Kesheng Dai
China, kdai@suda.edu.cn

EFFECTS OF DIFFERENT HYPERGRAVITY ON PLATELET FUNCTIONS AND THROMBUS FORMATION

Abstract

Purpose: Exposure to high gravity environments during short- or long-duration space missions or high-g training profiles has important medical and health implications for astronauts and pilots. We have recently reported that platelet functions were elevated under hypergravity, however, it is still unclear whether high-g is strong enough to activate platelets. The aim of the current study is to investigate whether high-g is strong enough to activate platelets leading to platelet thrombus formation, and the effects of different hypergravity on *in vivo* haemostasis.

Methods: Adult C57BL/6 black mice were anesthetized and subjected to various levels of hypergravity or 1 g as synchronous group. Thrombus formation was detected by immunohistochemistry analysis and the states of circulating platelets of mice were tested by tail-bleeding time assay and circulating platelet aggregates. P-selectin surface expression of platelets from treated mice was measured by Flow cytometry.

Results: The tail-bleeding time was significantly shortened in mice exposed to 12 g for 20 minutes compared with the synchronous 1 g controls. Immunohistochemistry analysis showed that platelet thrombi were formed in ventricle or blood vessels of the heart, or brain and lung from 12 g-exposed mice. P-selectin surface expression was significantly enhanced in platelets from 12 g-exposed mice compared with 1 g controls. The tail-bleeding time and the ratio of circulating platelet aggregates of mice exposed to 2 g for 20 minutes, 4 g for 10 minutes, or 8 g for 10 minutes, corresponding to hypergravity inflicted on astronauts during space missions, were significantly reduced. However, there was no obvious difference in tail-bleeding time between the 1 g controls and the mice exposed to 6 g for 80 seconds or 10 g for 60 seconds corresponding to some high-g training profiles.

Conclusions: These results indicate that platelets could be activated by hypergravity leading to platelet thrombus formation *in vivo*. The high gravity during some launch and re-entry is strong enough to elevate platelet functions, whereas, the high-g training profiles are relatively safe for most of the astronauts and pilots. These researches reveal the pathogenesis of gravity-change-related hemorrhagic and thrombotic diseases, and also suggest that the special attention should be paid to these kinds of diseases under different levels of gravity.