INFLIGHT PHARMACOKINETIC AND PHARMACODYNAMIC RESPONSES TO MEDICATIONS COMMONLY USED IN SPACEFLIGHT

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INTRODUCTION

Researchers do not know if medications act the same in the spaceflight environment as they do on Earth. Aspects of the spaceflight environment (low gravity, radiation exposure, closed environment, stress) have been shown to alter human physiology. Some of these physiological changes could be expected to alter either pharmacokinetics (PK, how the body absorbs, distributes, metabolizes and excretes administered medications) or pharmacodynamics (PD, receptors or signaling systems that are the targets of medication action). Anecdotal data has suggested that, at least for certain medications or indications, inflight medication efficacy is poor. In order to prepare for exploration missions where speedy evacuation to Earth may not be a possibility, the likelihood of unexpected medication action must be determined.

METHODS

This protocol was approved by the JSC IRB. This study will include administration of an antibiotic medication, either alone or in combination with sleep aid. Both study medications are FDA-approved prescription drugs and available for use on the ISS. After (double-blind) drug administration, blood samples will be collected over a period of 8 hours. These samples will be analyzed for content of the administered drug(s) and their metabolites, and pharmacokinetic analyses conducted. At the same time points when blood samples are collected, several measures of sleep/wakefulness and cognitive performance will be collected, including actigraphy, electroencephalography, and the psychomotor vigilance test (with the Cognition [1] suite of tests at certain, key, time points). This protocol will be conducted on crewmember volunteers pre-flight, during flight (post FD42), and post-flight so that flight-ground comparisons can be made for each individual.

RESULTS

Results from the “Rx Metabolism” study will provide unique information on pharmacokinetics and pharmacodynamics in a microgravity environment. This information will allow the medical community to provide crew members with the best possible treatment plans.

LITERATURE

[1] Basner, M., Savittet A., Moore, T.M., et al.: "Development and validation of the Cognition test battery", *Aerospace Medicine and Human Performance* 86(11): 942-952, 2015.