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# Drugs in Space and Medical Equipments During Space Projects

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## Abstract

**Although a number of astronauts and spacecraft have been sent in the area of microgravity, a number of drugs and medical equipment play a very vital role during any space project. Many of the medications which work in space have low efficiency, so that the astronauts used the drugs in very high doses. The main disease which is seen in astronauts is cardiac problems and insomnia. The drugs which are used in space heavily depend on the efficacy of the drug. If we talk about the drug having lower efficacy than expected in space. The duration of space flights gets longer, more problems are expected which will need sophisticated treatments. Various medical equipment are used to treat conditions associated with the spaceflight. Many projects overview given to astronauts to know about the medical equipment.**

***Keywords: Astronauts; Microgravity; Drug medication; Ttoxicity***

## Introduction

By the beginning of 2020, about 560 individuals have flown in space with the duration ranging from 15 min to 437 days. We are entering a new era of commercialized spaceflights, more and more individuals are going to travel from low earth orbit to deep space. Space travel causes multiple problems to the human body due to microgravity, radiation, confinement, isolation, changes in circadian rhythm, and stress. Space medicine is fundamental for the exploration of space. Space medicine supports survival, function and performance in the lethal environment [1]. The Crew Health Care System (CHeCS) and Health Maintenance Facility (HMF) provides medical equipment which is specifically suited to peculiarities of the mission. For the use in space the design and development involve adaptation of terrestrial components. The technical paper is provided as an overview of space station freedom deployable medical equipment design and their uses. The paper describes the life support of equipment and medical officers, patients, and equipment restraints [2].

## Medication and Efficacy of Drug Usage in Space

During the space mission the medication has been provided to prevent or treat conditions associated with the spaceflight And also for the management of preexisting illness or ordinary medical complaints. Space motion sickness, sleep deficiency, headache, backache, muscle or joint pain, bone resorption, congestion, and hypersensitivity reaction indication have included for the drug use in space. Recently enoxaparin and apixaban drugs were used for the treatment of jugular venous thrombosis in an astronaut. The Efficiency and safety of these drug treatments are largely unknown. Some of the medication may be less effective than expected. The nature of disease in space might be different pharmacokinetically and pharmacodynamically [1]. Some of the medications degraded more quickly than those on earth. The drug which does their job on the human body known

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as active ingredients has been measured in small amounts if we compared it with spaceflight to a ground-base control. The astronauts more heavily depend upon the efficacy of the drug [3]. the medical complaints caused by physiological changes and pharmacotherapy are required during space flight medication. Difficulty falling asleep causes Disruption in cardiac rhythm and the work stress leads to frequent intake of sleep promoting drugs during space missions. More than 70% of crew members are reported for using the sleep aid. The large number of multiple dose administration of sleep promoting drugs in the same night indicate a lack of efficacy after administration of the first dose. Drug classes that are taken during the space mission include congestion and allergy treatments, pain relievers, rash treatments, motion sickness prophylaxis and treatment, and alertness aids, with 21%-55% of crewmembers reporting their use [4].

## Pharmacokinetic in Space

Absorption-Oral route is one of the preferred routes for administration. The administration of medication in the microgravity environment has relative advantages and disadvantages of various dosage form formulations. Less data are present on bioavailability of drugs in space. Pool and Nicogossian are few of the oral medications. Which are taken during flight exhibited but the effect of that medication is less than expected. Pre-flight and in-flight salivary levels of acetaminophen are different due to changes in gastrointestinal transit time. In-flight salivary concentration-time curves of scopolamine/ dextroamphetamine, given oral tablets, also were shown to be erratic and exhibited higher intra- and inter-individual variability compared to those of preflight data.

Pulmonary absorption, there are differences between pulmonary perfusion in normal gravity and microgravity. In the study of deposition and dispersion of aerosol inhaled in microgravity shows differ form in normal gravity because of differences in sedimentation. Microgravity is more homogeneous and the diffusion capacity in lungs profusion. If the greater amount of corticosteroid enters in systemic circulation, resulting in a decrease in pharmacological effects and increased toxic effect [5].

## Pharmacodynamic in Space

Very less data are available which access the effect of the spaceflight environment on pharmacodynamics. Loss of plasma volume can alter the drug-receptor interaction in hypovolemic situations, and affect response of medication. Microgravity can also alter the function of some specific ion channel. The cardiovascular system is largely affected by the exposure to microgravity, leading to modifications in the pharmacological effect of antihypertensives and diuretics [6].

## Medical Standards or Equipments for Space Flights

Human space flights are a physiologically challenging environment with medical provision. The most successful method which can reduce the physiological risk imposed by space flight through screening. Consequently medical standards for space flight have played an important role. The being to select any medical condition might threaten either the safety of the crew or the goals of the mission. Standards for astronauts are more strict than the common aviator.

Exclusions are for conditions that:

- May cause acute loss of strength (e.g. coronary artery disease, renal stones, epilepsy)
- May interact with the space environment or life support systems (e.g. bullous lung disease or asthma; incompatible with sub-aqua diving or spacewalks)
- Are incompatible with a long duration deep space mission (e.g. may need to exclude stable chronic conditions requiring regular medication) [7]

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Nowadays special medical technology has been developed to match the technical requirements of the international space station to guarantee efficiency in the space environment. In this context there's still work to do in health care, research and development and requirements in space. Innovation in biomedical engineering integrates space medicines , space technology to match the need to explore beyond low earth orbit. The Heath Maintenance Facility (HMF) and a subsystem of the crew health care system support medical practice [8].

**Conclusion**

Many pharmaceutical products are employed in space to treat the different types of disorders ranging from gastrointestinal intestinal disturbance to insomnia. The duration of space flights gets longer, more problems are expected which will need new and sophisticated treatments. The knowledge of space medicines (pharmacokinetic, pharmacodynamic) aspects under microgravity will be helpful in making appropriate dosing recommendations [5]. Despite decades of drug use by astronauts during space missions, data on drug disposition under microgravity conditions are scarce and inconsistent. Numerous changes occur during spaceflight that affect the pharmacokinetic and pharmacodynamic properties of medication. Rude in drug stability and alteration in immune response might complicate pharmacotherapy in space. More research needs to be done to better understand medication efficacy and safety during spaceflight and how to optimize drug therapy for astronauts [4].

## REFERENCES


1. Eyal S. How do the pharmacokinetics of drugs change in astronauts in space. Expert Opin Drug Metab Toxicol.2020;16(5):353-56.
2. Gao C, Guo L, Gao F, et al. Innovation design of medical equipment based on TRIZ. Technol Health Care.2015;23(2):269-76.
3. Gold MS, Lincoln G, Cashman P, et al. Efficacy of m-Health for the detection of adverse events following immunization - The stimulated telephone assisted rapid safety surveillance (STARSS) randomised control trial. Vaccine.2021;39(2):332-42.
4. Kast J, Yu Y, Seubert C, et al. Drugs in space: Pharmacokinetics and pharmacodynamics in astronauts., European Journal of Pharmaceutical Sciences.2017;109:2–8.
5. Graebe A, Schuck E, Lensing P, et al. Physiological, Pharmacokinetic, and Pharmacodynamic Changes in Space., J Clin Pharmacol 2004;21(3):234-39.
6. Blue RS, Bayuse TM, Daniels VR, et al. Supplying a pharmacy for NASA exploration spaceflight: challenges and current understanding. NPJ Microgravity.2019;5:14-5.
7. Südfeld S, Brechnitz S, Wagner JY, et al. Post-induction hypotension and early intraoperative hypotension associated with general anaesthesia. Br J Anaesth.2017;119(1):51-9.
8. Cinelli I. Space Medicine Requirements open to Innovation in Biomedical Engineering. Annu Int Conf IEEE Eng Med Biol Soc.2018;45(2):973-76.


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