

Space Biology-Elucidation of Various Medical Space Equipments and Treatments

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Abstract

Space biology or aerobiology is concerned with the impact of outer space on living organisms which includes studying the lethal effects of space atmosphere on human body which includes hypoxia, radiations etc. Basically it is the study concerning with how conditions in extraterrestrial environment especially microgravity (less gravity) affect living organisms. The main objective of space biology is understanding of the impact of space flight to the human body such as international space station and ground based experiments that mimic the impact of space flight and to prepare human body for other space exploration missions far from earth. Being an astronaut is not an walk in the park, it has succumbed many scientists and crew members, by including proficient medical experts who have considerable surgical skills it is possible that the worse incidents can be mitigated.

Keywords: *Aerospace biology; Space; Space equipments; Aeronautics medicines; Space biologist; Space exploration; Space treatment*

Introduction

After NASA was established in 1958, their agency started contemplating the presence of life beyond earth. At first it was not easy finding a junction of robotic space programs with that of biology, but now these two programs are so interconnected that one is impossible without another. There is a cliché statement that ‘precaution is better than cure’ and for that all astronauts get training on how to use medical assets provided to them when they are on flight, there is paramedic training given to them to avoid any possible accident. Along with that they are provided with a specialised medical kit and equipments to carry out treatment in space. In accordance with ISS, basic kit contains first aid kit, a huge book of medical conditions and some important medical apparatus including defibrillator, portable ultrasound device, a device for looking deep into the eye and appreciable quantity of saline. Although, the best option still remains for the patient to return to earth but that’s too straightforward. The health of all astronauts and scientists are closely monitored for months before launch [1].

Scientists states that, the risk of an astronaut developing a serious illness is 1% to 2% per person per year. In control centres astronauts are closely observed collecting all kinds of data about their activities. Criteria for selection of medical equipments is quite simple, these must be small, light, robust, smart and low in power consumption. It is also important for astronauts to use the apparatus correctly too as Tim Peake, British astronaut and military officer was trained to properly use medical equipments and acts like a space paramedic. As in there will always be a need to increase the standards and emergency

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Medical Space Treatments

Non serious conditions

Space agencies like NASA and ISS are pushing it so far by sending astronauts deep into space, even on mars and asteroids. Going deeper in space leads to alteration in human psychological state due to bone loss, changes in immune system, fluid shifts, exposure of radiation etc. Pharmacokinetics and pharmacodynamics of the drugs can be altered as well when they are in completely different environments [3]. So that's make it really important for scientists to come up with specialised medical treatments to cope with the issues. Some non serious conditions in outer space includes Space adaptation sickness, motion sickness, headache, sleepiness, back pain, trauma burns, dermatological conditions, respiratory problems, syncope, nausea, vomiting etc [4].

Common conditions-space adaptation sickness

In case of space adaptation sickness, it originates from the vestibular system and it is due to weightlessness that occurs due to microgravity in outer space, space sickness differs from motion sickness based on the gravitational force present in the latter. Its common symptoms remain the same as that of motion sickness that are nausea and vomiting, its main cause is when vestibular system and visual system are not congruent to each other or also from neuronal mismatch. Treatment-Transdermal dimenhydrinate patches are used in space suits [5].

Statistics

Out of any other common condition space adaptation sickness occurs in most of the percentage of about 42.2% compared to other conditions. These conditions can be controlled by the basic first aid kit provided to the scientists prior to the launch of flight. Problem still remains with more serious emergencies [6].

More serious conditions

Apart from the common (non emergency situations) like space adaptation sickness, headache, sleepiness etc. space medical support systems must consider other conditions which are less likely to occur but are more deleterious, to get a proper contemplation of the physical state of the person in space. [7].

Heart conditions

Environment in space exposes the body to abnormal and unique environmental conditions. More serious and less likely conditions that can occur in space flight are heart attack, stroke, arrhythmia, hemorrhage, embolism, thrombotic complications etc. Arrhythmia being the most common to occur. Occurrence of atrial and ventricular premature contractions, short duration atrial fibrillation were reported by space agencies [8].

Arrhythmia is thought to occur due to low levels of potassium in the body and microgravity changes in the peripheral nervous system. Treatment-Radiofrequency catheter ablation [9].

Radiations

To get a proper vision for radiological research it is important for one to understand the radiation environment in space and how radiation influences the physiological and physical problems associated with the same. On earth the atmosphere is protective, the presence of different layers of atmosphere protects us from harmful radioactive radiations. In space without this barrier astronauts are prone to these radioactive radiations, their effect not being significantly lethal when astronauts are closer to the orbit but when they are in space for longer durations and farther from the earth for instance-1000 day mission on mars can prove harmful [10]. Staying away from earth's geomagnetic field causes these issues. Exposure of even a small dose of 0.1 Gy or 0.2 Gy of Iron-56 has proven degenerative changes in mouse coronary artery in experimental studies. It is important

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for space agencies to consider these issues while planning for a long term flight. Exposure of radiation in astronauts increases the risk of cancer or developing acute radiation syndrome. Shielding can help to some extent but it is ineffective in protecting from highly Galactic Cosmic Radiation (GCR) which has deleterious effects on health. GCR ions contain highly energetic alpha particles. Treatment-Hydrogen rich shielding such as polyethylene is able to reduce incidence of exposure of crew members to these radiations.

Medical Equipments in Space

Along with the development of space tourism, the need for more medically trained specialists has increased. When the duration and distance from earth increases, frequency of necessity to do medical and surgical events become inevitable. Since returning back to the grounds is not an option, medical expertise is required to be trained to the crew members or inclusion of specialists in clinical skills and those who have medical expertise yet it all goes down to the handling of the emergencies at the moment. Although ground based medical support services of the agencies and institutes of biomedics are augmented by telemedicines and intelligent communication networks, that help is limited to providing assistance to the spacecraft near the orbit of earth. Other training of crew members includes medical instruction and basic surgical skills like suturing. As the spacecraft moves far from the orbit, the telemetric support system by network keeps on delaying, as in mars it takes 44 minutes for two way radio contact. In these kinds of missions a physician with paramedic training is a prerequisite who has profound knowledge and proficiency in surgical skills and procedures [11].

Even though there are many potential barriers that hinders performing surgery, still it is possible. Medical equipment selection for space must follow highly specific characteristics like weight and size specificity for which an isolated and dangerous environment is accountable. Along with the health care system office NASA medical operations specifies the standard training and equipment required for spaceflight. As of this the space shuttle and ISS are equipped for only minor procedures and basic medical treatments using the supplies manifested on the shuttle orbital medical system [12].

Conclusion

By creating a conjunction between biology and aeronautics, standards of the space flight and development of life sciences are being upgraded. These two fields are interwoven such that both are equally benefited. In life sciences, increased opportunities of experimentation by monitoring aeronautical environment and the possibility of life beyond earth can be tracked down and in aeronautics, ensuring the safety and successful homecoming of our astronauts but still it is far way to go yet.

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