

Space Radiations and Carcinogenesis: A Review

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ABSTRACT

Radiation is defined as energy transmitted in the form of highly charged particles and electromagnetic waves, which moves in tremendously fast speed. Radiation present on earth around us is in many forms. We have two main types of radiation, i.e. ionizing and non-ionizing radiation. Even in the outer space, we are surrounded by radiations which we summarize as space radiations. Space radiations are ionizing in nature and consist of very highly charged particles that are constantly been flowing in the outer space. With the advancement in the field of astrophysics, space explorations have become the most useful tool to gather information of outer space and to get the answers of unknown facts of the universe. Many space missions that have been covered so far with the help of human controlled spacecrafts. All those astronauts who travel in space for a longer duration are under severe negative health effects more or less depending on their individual immune mechanisms. This review enlightens the least discussed topic in oral medicine, which focuses primarily on carcinogenic changes that take place after multiple or long-term cosmic radiations exposure.

Keywords: Astronauts, Carcinogenesis, Cosmic radiation, Space radiation

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INTRODUCTION

Radiation is defined as energy transmitted in the form of highly charged particles and electromagnetic waves which moves in tremendously fast speed. Radiation present on earth around us is in many forms. We have two main types of radiation, i.e., ionizing and non-ionizing radiation. Even in the outer space, we are surrounded by radiations which we summarize as space radiations. Space radiations are ionizing in nature and consist of very highly charged particles that are been constantly flowing in the outer space.¹ Cosmic radiations principally consist of charged particles in the form of galacto-cosmic radiations or solar particles and entrapped radiations or both. Entrapped radiations are certain electro-magnetic waves that are been formed from earth's magnetic field and which extends several kilometers from earth's surface. Solar particles are part of solar radiation. It is formed when solar particles constantly flow radiations at a speed of 1 million miles/h.² This stream of particles is known as solar wind that contains a mixture of numerous elements. Few of

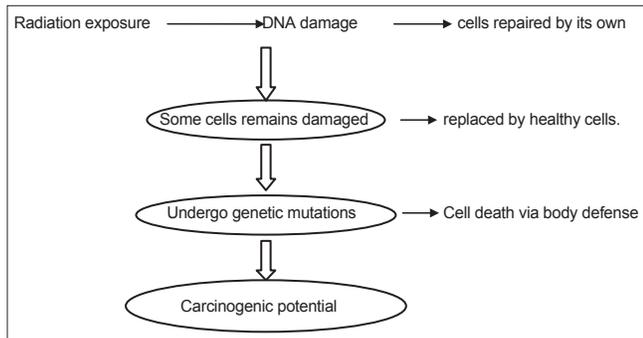
them are part of our periodic table and remaining are still unknown to us.

EFFECT OF RADIATION ON HUMAN BODY ON EARTH

Nowadays the use of radiations is increasing day by day with new advancements in the field of science. Every electronic device is ranging from a small phone to big radar or spacecraft consists of radiation emitting device which hazardously affect the human body. The harmful effects of radiations depend on the amount of dose of radiation and its duration of contact with the human body. In small quantity and controlled dose, harmful radiation can be modified and used in a therapeutic purpose as in the case of radiotherapy for cancer.³ Most of the radiation effects are harmful to us starting from microwaves to atomic nuclear radiations. These high energy radiations not only destroys the exposed human body but also the effect of such strong and powerful radiation remains for very long time with in the environment and affects generation after generation of

living beings belonging to that region, like in Hiroshima and Nagasaki atomic explosion.⁴

Radiation has an effect on the human body when more than 100 mSv is received all at once. If the exposure is for a small duration, the human body tend to repair on its own but not in case of longer exposure.⁵ Radiation causes genetic changes by breaking down DNA or by causing mutations in genes.



Risk of cancer increases by 0.5% when the radiation exposure increase from 100 mSv and above.

Other harmful effects of radiation exposure are nausea, vomiting, hair loss, skin lesions, permanent infertility, libido, opacity of eye lenses, loss of hearing, oral ulcerations, mental retardation, congenitally missing phalanges of hands and legs.⁶

EFFECT OF COSMIC RADIATIONS ON ASTRONAUTS

Radiation in space takes the form of subatomic particles from the sun and other sources from Milky Way galaxy and far. This high speed atomic particles cause tearing of DNA of cells resulting in cellular damage. Damaged DNA can also undergo mutations resulting into carcinogenic changes. Radiation exposure can be acute, i.e. for short duration and chronic, i.e., for longer duration. Being on earth or with in the earth's electric and magnetic field, human body is protected from harmful cosmic radiations.⁷ Earth's electric and magnetic field provides a shielding effect and protects us from about 99% of cosmic radiations. During a round trip from earth to mars by an astronaut, the shortest amount of radiation exposed is about 0.66-0.70 Sv. A dose of 1 Sv is enough to increase the risk of malignant potential in tissues by many times. Normal daily radiation exposure in humans ranges between 1 and 10 mSv. Unlike earth, other planets have no magnetic or electric field of its own. So there is no protection from space radiations once being out of earth's environment. One of the most dangerous incidences includes coronal mass ejection, from sun's

stroma. These are large bubbles of plasma surrounded by strong magnetic field with high energy neutrinos, which move constantly in all directions of space. These remain almost invisible when emitted in small quantity and can penetrate the astronaut space suite with great easy producing mild harmful effects such as vertigo, dizziness, nausea, blurred vision and skin allergy.

Protection from radiations

Earth's environment is best suited for humans. No other planet or any other location in space is found to be as safe as earth is. As being an astronaut, to avoid space summits is not practically possible. However, it is equally important to take care of the hazardous effects from radiation. Some precaution should be followed prior to space mission planning.⁸ Proper shielding should be provided with in the space craft as well as in the space suite so that when the astronaut visits outer space, the least number of radiations exposed resulting in least side-effects. Smaller duration summit is better than longer duration space missions. Less the time spend in outer space, least will be the harmful effects. Depending on individual's immunity, some will have more harmful effects while others will have less.

CONCLUSION

Humans are physiologically and psychologically well suited with earth's atmosphere. Though space missions are very important for future development in the field of astrology and astrophysics, yet the life of astronauts is equally important. This should be kept in mind that in every space mission proper protection of the crew members is most important aspect because they are the only backbone of future.⁹

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How to cite this article: Bohra A, Bohra R, Bohra U. Space Radiations and Carcinogenesis: A Review. *Int J Adv Health Sci* 2014;1(8):23-25.

Source of Support: Nil, **Conflict of Interest:** None declared.