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Medical Care for Humans in Space (3)

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INTERVENTIONAL RADIOLOGY IN SPACE, A NEW AND PROMISING CURE

Abstract

Background/Purpose: Space exploration is constantly pushing the boundaries. While this exploration brings excitement, it also brings its own challenges. Because of unavailable real-time communication for medical guidance, and because of the inherent increased risk of medical conditions related to travel time, new medical challenges arise with faraway destinations like Mars. Astronauts should be able to independently and safely treat a broad range of medical conditions, with limited material. Interventional radiology (IR) is a subspecialty of radiology that offers minimally invasive treatments under imaging guidance. We investigate whether IR would be an appropriate option to treat a large number of medical conditions with limited medical resources. **Methods:** Interventional Radiology In Space (IRIS) group is a French collaborative group created in 2023 and composed of interventional radiologists, airline pilot, and engineers from CNES and Institute for Space Medicine and Physiology working towards implementing IR in space. We based our evaluation on the NASA literature on in-flight medical condition list and risks

to evaluate the suitability of IR techniques to cover a wide range of pathologies likely to occur in the context of long-duration manned flight, without significant increase in on-board medical resources, and in a safe manner by an astronaut that can be easily and quickly trained. Because of onboard equipment restrictions, ultrasound (US) guidance has been identified as the imaging guiding modality of choice. Nephrolithiasis (renal colic) was identified as the archetypal pathology model in which IR would be the answer. The IR treatment of this pathology by drainage is similar on a technical point of view to a vast majority of pathology in which IR would have its place. Results: IRIS group developed a step-approach to investigate the value of IR in space. First, we developed a toolbox with the minimum material required to treat the maximum pathology treatable by IR, to answer the weight-to-volume ratio restrictions of spaceflight. Second, we trained analog astronauts to perform safely and confidently the drainage under US. Third, we are working to identify in microgravity (0G flight) the best (safest and most efficient) IR drainage techniques and the possible unexpected challenges of IR procedures. Conclusions: Interventional radiology is a promising medical field for space medicine to safely, quickly and independently treat a vast majority of pathology with minimum medical resources. Further objectives of IRIS group would be to offer this toolbox in remote places on Earth and to develop other IR procedures in space.