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DRAIN BRAIN 2.0: ASSESMENT OF THE CEREBRAL VENOUS RETURN IN MICROGRAVITY

Abstract

Future human exploration missions will eventually comprise prolonged periods in microgravity and planetary surface activities in low gravity (less than 1G) environments. Exposure to microgravity leads to a headward shift of body fluids and is associated with a number of medical issues that have the potential to compromise mission safety and success of future planetary space explorations. Concerning the cerebral venous outflow, recent reports suggest that stagnant and even retrograde venous flow in the jugular venous system may potentially lead to deep vein thrombosis within these vessels. Our aim is to validate a cervical plethysmography system as a suitable instrument to be permanently housed on the ISS. Thanks to its portability, non-invasiveness and ease of use, the plethysmography system can represent an ideal tool for the systematic monitoring of cardiovascular parameters of crew members. Since the jugular pulsatility disappears or significantly attenuates in the event of thrombosis in the segment between the atrium and the detection point in the neck, the plethysmograph has the potential to become a rapid screening tool for jugular thrombosis in future space missions. Plethysmography is a noninvasive technique for recording volume changes in a tissue that, unlike Doppler ultrasound, overcomes operator dependence on the acquired measurement. Overall, the goal of the project concerns the development of a new plethysmography system to study the cerebral venous return in microgravity, to understand the phenomena of physiological adaptation, and to identify possible thrombosis caused by the physical stress from non-terrestrial gravitational conditions. In particular, the objective of the project regards the detection of the Jugular Venous Pulse (JVP) objectively and quantitatively. The JVP detection will be carried out with a cervical plethysmography system on a statistically significant number of subjects under microgravity conditions, extrapolating parameters related to volaemia, cardiac filling, and cerebral venous drainage.