¿How Space Changes Astronauts' Brains?

The negative effects of space exposure on the central nervous system

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INTRODUCTION

After nearly 60 years of manned space travel, there are many unknowns about the effects of spaceflight on the human brain. Long-duration spaceflight causes widespread physiological changes, although its effect on brain structure remains poorly understood. Humans undergo extreme physiological changes when subjected to long periods of weightlessness, and as we continue to become a space-faring species, it is imperative that we fully understand the physiological changes that occur in the human body, including the brain. (1,2)

We found increased white matter in the cerebellum after spaceflight, providing the first clear evidence of sensorimotor neuroplasticity. At the region of interest level, this increase persisted 7 months after return to Earth. (3,4)

Twelve months of spaceflight resulted in greater structural brain changes in sensorimotor, frontal, and ventricular brain regions compared with 6 months of spaceflight. The length of time between missions and prior flight experience may play a role in how spaceflight affects brain structure. All brain changes, aside from ventricular volume increases, fully recovered by 6 months after flight. That is, these structural brain changes do not plateau during flight but instead continue through 1 year in space. It is unknown whether these brain changes represent nonspecific structural atrophy, cephalad fluid shifts, and/or adaptive neuroplasticity. (1,5)

Astronauts returning from spaceflight typically show transient declines in mobility and balance. Other sensorimotor behaviors and cognitive function have not been investigated as much. Upon return to Earth, microgravity adaptions become maladaptive for certain postural tasks, resulting in transient sensorimotor performance declines that recover within 30 days.(4,5)

MATERIALS / METHODS

Standardized bibliographic review, with the comparison of case reports through NASA-USA support. a review of 100 research articles was developed, producing a complete analytical report of the evidence up to the time of aerospace medicine and its neurological effects.

CONCLUSIONS

The main findings are tension headache during and after astronaut travel, there are also imaging findings of participants in space travel and without space travel exposed to microgravity models with demyelination, axonal loss or edema, as a side effect on brains exposed to microgravity.

RESULTS

Maintaining neurological function in long-term travel through space exposure is vital for both astronaut health and mission safety. There is a risk of long-term neurological sequelae, predisposing to headaches, convulsions and cognitive impairment.

OBJECTIVES

The objective of this work is to make known the general adaptations that it reveals to go to space. the brain is a very sensitive organ to the changes it generates, exposed to low and high gravity forces.

As NASA proceeds with plans to send astronauts to the Moon and commercial space travel interest increases, it is critical to understand how the human brain and peripheral nervous system respond to zero gravity.

ACKNOWLEDGEMENTS

We thank the academic instructors of NASA's human research program for providing information and allowing this experience to contribute to the medical literature. we thank Carolina Salguero and María Virginia Pinzón for their unconditional support.

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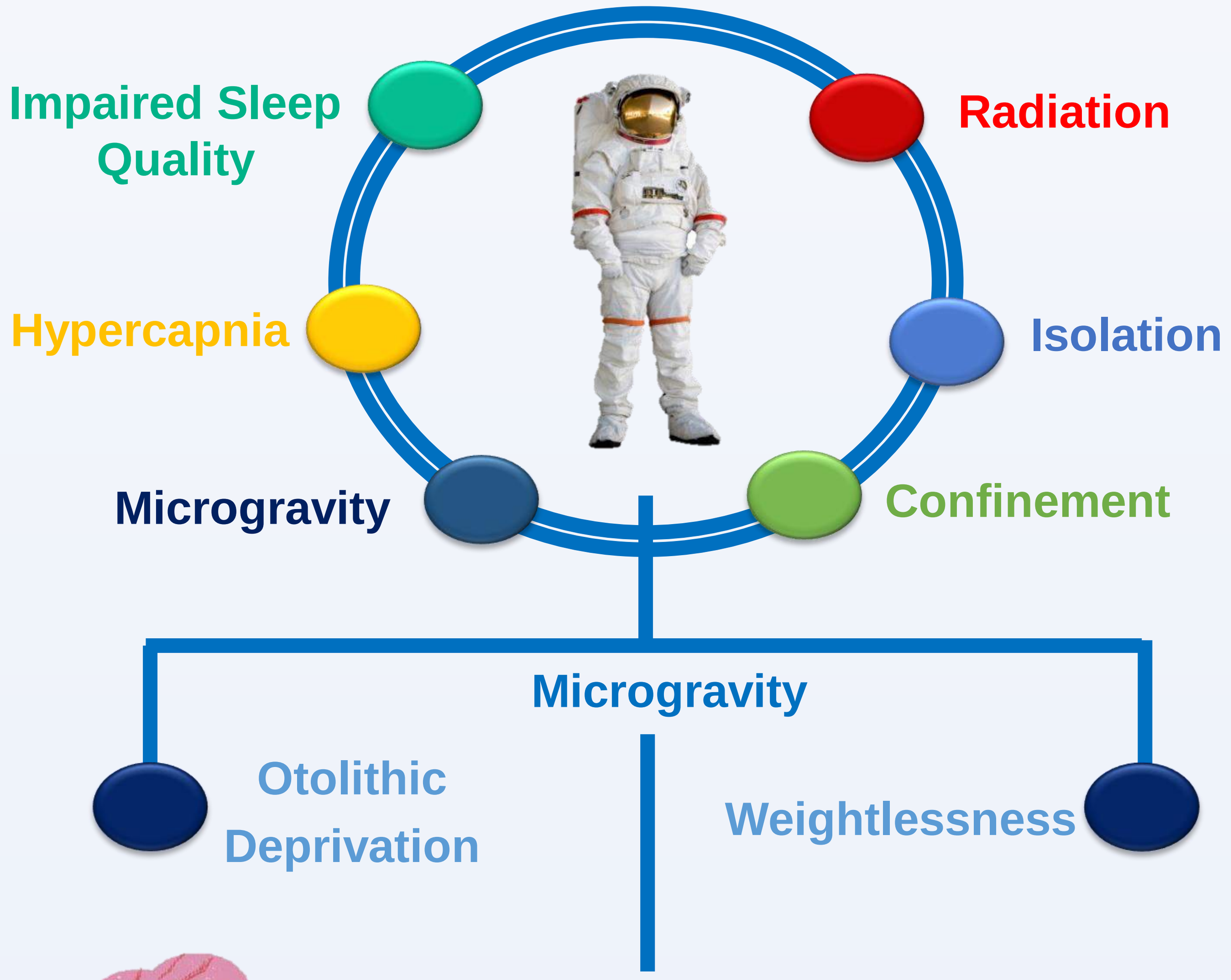
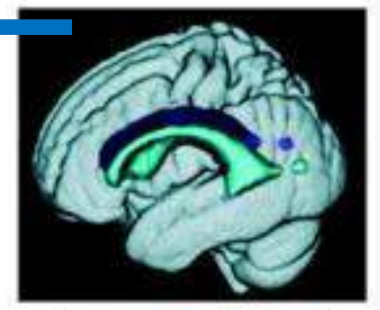
Spaceflight- associated stressors to the brain



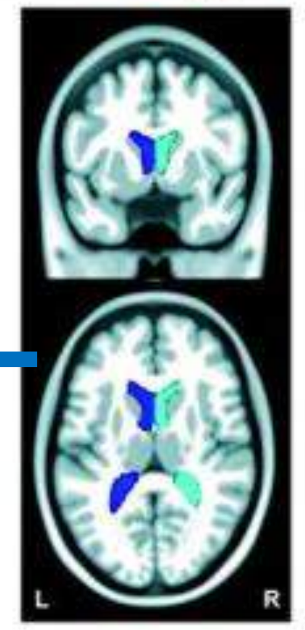
The volume of grey matter in the regions that control the movement of the legs and process the sensory information of the same also increased.

The brains of astronauts performing space missions are compressed and expanded during space flight.

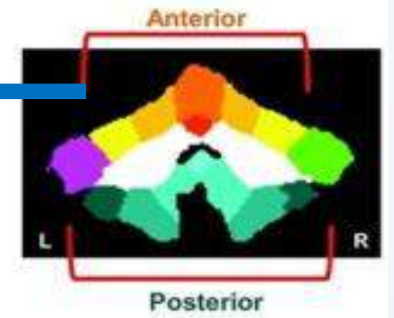
Changes in volume and associated factors can expose the brains to effect symptoms and signs of known pathologies in space. We have much to learn.



LEFT LATERAL VENTRICLE - Change in units of volume (% of baseline ventricular volume). Changes in the basal volume of a brain in the control group earth are 2%. Astronauts that last 6 months outside of Earth's gravity have a volume increase of 16.4%. Space flights of 12 months duration have a volume increase of 20.93%.

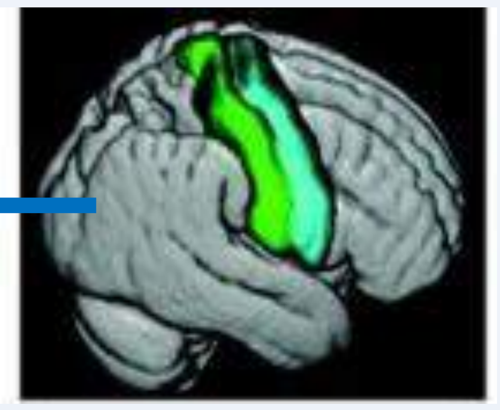


RIGHT LATERAL VENTRICLE - Change in units of volume (% of baseline ventricular volume). Changes in the basal volume of a brain in the control group earth are 2.96%. Astronauts that last 6 months outside of Earth's gravity have a volume increase of 23.54%. Space flights of 12 months duration have a volume increase of 22.71%.



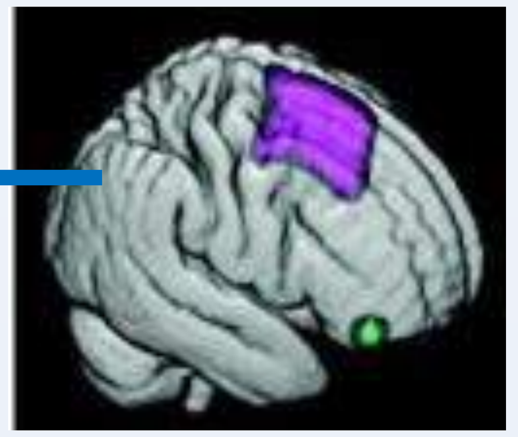
Cerebellar volume changes with spaceflight and aging. ANTERIOR CEREBELLUM - Changes in the basal volume of a brain in the control group earth are 0,1%. Changes during space flight, there is evidence to increase 1.86% the volume and in other astronauts to decrease its volume -2.14%. 6-month space travel, you have increase of 0.42% its volume.

POSTERIOR CEREBELLUM - Changes in the basal volume of a brain in the control group earth are 0,1%. Changes during space flight, there is evidence to increase 0.34% the volume and in other astronauts to decrease its volume -2.06%. 6-month space travel, you have increase of 1.50% its volume.



RIGHT PRECENTRAL GYRUS- It evidences changes of increase to 12 months of space flights of +0.22% between 0.26% of the volume, the journeys of 6 months have decrease of the volume of 0.22%.

Right Postcentral Gyrus - It evidences changes of increase to 12 months of space flights of +0.33% between 0.28% of the volume, the journeys of 6 months have decrease of the volume of 0.29%.



RIGHT SUPPLEMENTARY MOTOR AREA- It evidences changes of increase to 12 months of space flights of -5.5% between -2.73% of the volume, the journeys of 6 months have decrease of the volume of -2.71%.

RIGHT FRONTAL POLE - It evidences changes of increase to 12 months of space flights of +6.55% between +6.04% of the volume, 6-month trips have increased the volume by +4.89%.

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