Spaceflight

Spaceflight places astronauts in multiple environments capable of inducing pathological changes.

Spaceflight has always been met with awe by the general public and may also have strong implications for medical training for future physicians, regardless of specialty or practice. Within the near future, the commercialization of spaceflight will lead to an unprecedented surge in travelers to space. With this increase, the understanding of space medicine and the potential physiological risks of microgravity will only become more important for doctors to understand. Historically, teaching education on how the body responds to various different environments and environmental changes has been a longstanding core to medical education. Thus, education about the physiological, pathologic, and histologic changes to weightlessness over prolonged periods of time will likely provide additional insights into space medicine, as well as how medicine can be practiced here on Earth. The addition of space medicine to the medical curriculum will likely not only benefit future space medicine physicians but also likely benefit all physicians and human health on Earth. In this manuscript, we discuss the various risks that astronauts undergo, as well as current space medicine education initiatives on Earth [1)]

Alterations in the spine have a significant impact on astronauts' health during and after spaceflight. Low back pain is an established and common intra-flight complaint. Intervertebral disc herniation occurs at higher rates in this population and poses significant morbidity. Morphological changes within intervertebral discs, vertebral bodies, and spinal postural muscles affect overall spine function and astronaut performance. There remains a paucity of research related to spaceflight-induced pathologies, and currently available reviews concern the central nervous system broadly while lacking emphasis on spinal function.

Objective: Our aim was to review and summarize available data regarding changes in spinal health with exposure to spaceflight, especially focusing on the effects of microgravity. The authors also present promising diagnostic and treatment approach wherein the neurosurgeon could positively impact astronauts' health and post-flight outcomes.

Materials and methods: Articles included in this review were identified via search engine using MEDLINE, PubMed, Cochrane Review, Google Scholar, and references within other relevant articles. Search criteria included “spine and spaceflight”, “vertebral column and spaceflight”, “vertebral disc and spaceflight”, and “muscle atrophy and spaceflight”, with results limited to articles written in English from 1961 to 2020. References of selected articles were included as appropriate.

Results: Fifty-six articles were included in this review. Compositional changes at the intervertebral discs, vertebral bone, and paraspinal muscles contribute to undesirable effects on astronaut spinal function in space and contribute to post-flight pathologies. Risk of intervertebral disc herniation increases, especially during post-flight recovery. Vertebral bone degeneration in microgravity may increase risk for herniation and fracture. Paraspinal muscle atrophy contributes to low back pain, poorer spine health, and reduced stability.

Conclusion: Anatomical changes in microgravity contribute to the development of spinal pathologies. Microgravity impacts sensory neurovestibular function, neuromuscular output, genetic expression,

among other systems. Future developments in imaging and therapeutic interventions may better analyze these changes and offer targeted therapeutic interventions to decrease the burden of pain and other diseases of the spine in this population [2].

Spaceflight associated neuro-ocular syndrome

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2)
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