Introduction

Ultrasonography is increasingly used to quickly measure optic nerve sheath diameter (ONSD) when increased intracranial pressure (ICP) is suspected [1]. NASA Space and Clinical Operations Division has been using ground and on-orbit ultrasound since 2009 as a proxy for ICP in non-acute monitoring for space medicine purposes. In the terrestrial emergency room population, an ONSD greater than 0.59 cm is considered highly predictive of elevated intracranial pressure [1]. However, this cut-off limit is not applicable to the spaceflight setting since over 50% of US Operating Segment (USOS) astronauts have an ONSD > 0.60 cm even before launch. Crew Surgeons must therefore develop new decision-making criteria. Our data characterize the longitudinal trends in ONSD in the astronaut corps, and the predictive power of this measure related to increased ICP outcomes.

Results

Within the astronaut cohort, we have determined that ultrasound measurement of ONSD using a standardized method has high inter-rater reliability. Terrestrial values for ONSD have limited generalizability to the astronaut population due to significant differences in the setting, health status, population characteristics, and measurement fidelity. This necessitated creation of population-specific distribution curves.

Conclusions

1. A cohort-specific distribution curve of the ONSD values was successfully created, thus providing a reference framework for clinical use of ONSD.
2. Astronauts who developed disc edema started out with larger preflight ONSD values (difference of 0.09; 95%CI: 0.06, 0.13; p<0.001).
3. Inflight ONSD appears to moderately increase (difference of 0.05; 95%CI: 0.01, 0.10; p<0.0001)
4. More data are necessary to assess the clinical significance of trends within an individual astronaut.

Future Work

Optic nerve sheath diameter is just one of the many features of the eye and orbit assessed with ultrasonography. Other features include globe length, disc elevation, and posterior globe flattening. A broader analysis is underway to examine the value of these anatomical and functional criteria for clinical management, as well as to elucidate the intricate mechanisms in the pathogenesis of VIP phenomena.

Reference