AJNR

Reply:

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AJNR Am J Neuroradiol 2024, 45 (5) E7
doi: https://doi.org/10.3174/ajnr.A8279
http://www.ajnr.org/content/45/5/E7

REPLY:

We thank Wostyn et al[1] for their comments and for the alternative explanation, based on venous congestion, that they provide for the perivascular space (PVS) volume increase observed in the bed rest subjects in our study.[2] Indeed, altered cerebral venous hemodynamics have been documented in astronauts,[3,4] and we have shown an increase in PVS volumes in astronauts and cosmonauts after spaceflight.[5] Although altered venous outflow would be expected to have occurred in the bed rest subjects participating in our study, it was not measured. Taken together, these results suggest that an altered cerebrovascular physiology occurs both in the ground-based spaceflight analog of head-down tilt bed rest and during long-term spaceflight. The relative contributions that altered arterial or venous flow may have made individually or collectively to increase the PVS volume are unclear, suggesting further studies are needed to disentangle the underlying mechanisms involved. In that regard, advanced MR imaging techniques including MRA, MRV, and SWI sequences (which enhance the visualization of small venous structures) should be included in future MR imaging protocols used in head-down tilt bed rest studies and for pre- and postflight astronaut brain MR imaging.[6]

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http://dx.doi.org/10.3174/ajnr.A8279