

Neuroimaging Findings in US Government Personnel With Possible Exposure to Directional Phenomena in Havana, Cuba

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Key Points

Question Do advanced neuroimaging findings differ between US government personnel who experienced neurological signs and symptoms after potential exposure to directional phenomena in Havana, Cuba, and individuals not exposed to directional phenomena?

Findings In this study comparing 40 US government personnel with 48 healthy controls, advanced brain magnetic resonance imaging techniques revealed significant between-group differences in whole brain white matter volume, regional gray and white matter volume, cerebellar tissue microstructural integrity, and functional connectivity in the auditory and visuospatial subnetworks but not in the executive control subnetwork.

Meaning Neuroimaging findings differed between controls and US government personnel who experienced neurological signs and symptoms after potential directional phenomena exposure in Havana, Cuba, although the clinical relevance of these differences is uncertain and may require further study.

Abstract

Importance United States government personnel experienced potential exposures to uncharacterized directional phenomena while serving in Havana, Cuba, from late 2016 through May 2018. The underlying neuroanatomical findings have not been described.

Objective To examine potential differences in brain tissue volume, microstructure, and functional connectivity in government personnel compared with individuals not exposed to directional phenomena.

Design, Setting, and Participants Forty government personnel (patients) who were potentially exposed and experienced neurological symptoms underwent evaluation at a US academic medical center from August 21, 2017, to June 8, 2018, including advanced structural and functional magnetic resonance imaging analytics. Findings were compared with imaging findings of 48 demographically similar healthy controls.

Exposures Potential exposure to uncharacterized directional phenomena of unknown etiology, manifesting as pressure, vibration, or sound.

Main Outcomes and Measures Potential imaging-based differences between patients and controls with regard to (1) white matter and gray matter total and regional brain volumes, (2) cerebellar tissue microstructure metrics (eg, mean diffusivity), and (3) functional connectivity in the visuospatial, auditory, and executive control subnetworks.

Results Imaging studies were completed for 40 patients (mean age, 40.4 years; 23 [57.5%] men; imaging performed a median of 188 [range, 4-403] days after initial exposure) and 48 controls (mean age, 37.6 years; 33 [68.8%] men). Mean whole brain white matter volume was significantly smaller in patients compared with controls (patients: 542.22 cm³; controls: 569.61 cm³; difference, -27.39 [95% CI, -37.93 to -16.84] cm³; $P < .001$), with no significant difference in the whole brain gray matter volume (patients: 698.55 cm³; controls: 691.83 cm³; difference, 6.72 [95% CI, -4.83 to 18.27] cm³; $P = .25$). Among patients compared with controls, there were significantly greater ventral diencephalon and cerebellar gray matter volumes and significantly smaller frontal, occipital, and parietal lobe white matter volumes; significantly lower mean diffusivity in the inferior vermis of the cerebellum (patients: 7.71×10^{-4} mm²/s; controls: 8.98×10^{-4} mm²/s; difference, -1.27×10^{-4} [95% CI, -1.93×10^{-4} to -6.17×10^{-5}] mm²/s; $P < .001$); and significantly lower mean functional connectivity in the auditory subnetwork (patients: 0.45; controls: 0.61; difference, -0.16 [95% CI, -0.26 to -0.05]; $P = .003$) and visuospatial subnetwork (patients: 0.30; controls: 0.40; difference, -0.10 [95% CI, -0.16 to -0.04]; $P = .002$) but not in the executive control subnetwork (patients: 0.24; controls: 0.25; difference: -0.016 [95% CI, -0.04 to 0.01]; $P = .23$).

Conclusions and Relevance Among US government personnel in Havana, Cuba, with potential exposure to directional phenomena, compared with healthy controls, advanced brain magnetic resonance imaging revealed significant differences in whole brain white matter volume, regional gray and white matter volumes, cerebellar tissue microstructural integrity, and functional connectivity in the auditory and visuospatial subnetworks but not in the executive control subnetwork. The clinical importance of these differences is uncertain and may require further study.