Advanced Neuroimaging Findings in a Patient with Neurotoxin-Exposure Related Parkinson's Disease: A Case Report

Kevin A. Garcia Valdez
The University of Texas Rio Grande Valley School of Medicine, Kevin.garciavaldez01@utrgv.edu

Blake Martin
The University of Texas Rio Grande Valley School of Medicine, blake.martin01@utrgv.edu

Jared Hensley
The University of Texas Rio Grande Valley School of Medicine, jared.hensley01@utrgv.edu

Hunter M. Butler
The University of Texas Rio Grande Valley School of Medicine, hunter.butler01@utrgv.edu

Russel W. Wiggins
The University of Texas Rio Grande Valley School of Medicine, russell.wiggins01@utrgv.edu

See next page for additional authors

Presenter Information (List ALL Authors)
Kevin A. Garcia Valdez, Blake Martin, Jared Hensley, Hunter M. Butler, Russel W. Wiggins, Daniel Salinas, Chloe Harris, Nawaz Hack, and Kelsey Baker

Advanced Neuroimaging Findings in a Patient with Neurotoxin-Exposure Related Parkinson's Disease: A Case Report

Kevin Garcia Valdez, Daniel Salinas, Blake Martin, Jared Hensley, Hunter M. Butler, Russell W. Wiggins, Nawaz Hack, Kelsey Baker

Background: Neurotoxin exposure has been linked to a variety of neurological conditions and diseases. This is likely because many neurotoxins (natural and synthetic) can cross the blood brain barrier and impact the structure and function of neuronal cells and pathways. In particular, neurotoxin exposure has had a strong association with development of Parkinson's Disease (PD), with the Department of Veteran's affairs acknowledging the link in 2010. Here, we seek to understand if patients with PD and a history of neurotoxin-exposure demonstrate a different disease pathophysiology. Specifically, we want to evaluate microstructural changes in the brain in patients with PD and a history of neurotoxin-exposure.

Methods: Methods: We enrolled one subject with neurotoxin-related PD and one healthy control. The enrolled PD patient identified household lead pipes for neurotoxin exposure and was classified a 2 on the Hoen-Yahr scale by study physician. Following enrollment, the patient and control underwent magnetic resonance imaging (MRI) of the brain. Our scanning sequence included structural (T1) imaging, and multi-shell diffusion weighted imaging (DWI). Images were preprocessed using FSL and Neurite Orientation Dispersion and Density Imaging (NODDI) post processing was calculated using Accelerated Microstructure Imaging via Convex Optimization (AMICO). For both PD patient and healthy control subjects, the region of interest (ROI) of subthalamic nucleus was drawn and analysis performed using FSL.

Results: The subthalamic nucleus from the healthy control and a patient with Parkinson's Disease with exposure to household lead, were evaluated for neurite density and volume. The healthy control had values of 2221.556810 and 256.640625 mm^3 for neurite density and volume, respectively. The patient with PD had a density of 2184.348319 and a volume of 195.117106 mm^3.

Conclusions: When neurotoxins enter the nervous system, they alter the structure and function of neuronal pathways. These changes have been linked to neurodegenerative disorders such as Parkinson's Disease. Utilizing NODDI, the microstructure of the subthalamic nucleus on a patient with PD showed a marked reduction in neurite density and volume as compared with a control subject with no history of neurotoxin exposure. The results suggest that exposure to neurotoxins such as household lead pipe can impact neuronal architecture. In future research, it would be relevant to evaluate the extent of microstructural changes and their relationship with clinical symptoms such as tremors, cognitive impairment, and behavioral changes.