Exploring Neuroplasticity Changes in Neurotoxin-induced Parkinson’s Disease: A Preliminary Analysis using Transcranial Magnetic Stimulation

Tomas Gomez Jr.
*The University of Texas Rio Grande Valley School of Medicine, Tomas.gomez01@utrgv.edu*

Daniel Salinas
*The University of Texas Rio Grande Valley School of Medicine, daniel.salinas02@utrgv.edu*

Kelsey Potter-Baker
*The University of Texas Rio Grande Valley School of Medicine, kelsey.baker@utrgv.edu*

Nawaz Hack
*The University of Texas Rio Grande Valley School of Medicine, nawaz.hack@utrgv.edu*

Ramu Vadukapuram
*The University of Texas Rio Grande Valley School of Medicine, Ramu.vadukapuram@utrgv.edu*

Follow this and additional works at: [https://scholarworks.utrgv.edu/somrs](https://scholarworks.utrgv.edu/somrs)

Part of the [Bioinformatics Commons](https://scholarworks.utrgv.edu/somrs), [Medical Neurobiology Commons](https://scholarworks.utrgv.edu/somrs), [Neurosciences Commons](https://scholarworks.utrgv.edu/somrs), and the [Other Neuroscience and Neurobiology Commons](https://scholarworks.utrgv.edu/somrs)

**Recommended Citation**
[https://scholarworks.utrgv.edu/somrs/2024/talks/15](https://scholarworks.utrgv.edu/somrs/2024/talks/15)

This Oral Presentation is brought to you for free and open access by the School of Medicine at ScholarWorks @ UTRGV. It has been accepted for inclusion in Research Symposium by an authorized administrator of ScholarWorks @ UTRGV. For more information, please contact justin.white@utrgv.edu, william.flores01@utrgv.edu.
Exploring Neuroplasticity Changes in Neurotoxin-induced Parkinson’s Disease: A Preliminary Analysis using Transcranial Magnetic Stimulation


University of Texas Rio Grande Valley Institute of Neuroscience

Background: Parkinson’s disease (PD) is a neurodegenerative condition that affects movement, cognition, gait, and significantly impacts one’s quality of life. Studies have suggested that neurotoxin pre-exposure is related to PD pathology and progressive motor/non-motor deficits, though it remains unclear how neurotoxin exposure affects neuroplasticity. The present study aimed to examine neurotoxin–induced PD-associated neuroplasticity changes in relationship to mental acuity and PD motor functionalities.

Methods: 7 voluntary participants experiencing early-stage PD symptoms with self-reported neurotoxin pre-exposure were enrolled in the longitudinal, repeated-measures clinical study; 2 sex-matched, age-matched, and occupation-matched healthy subjects were recruited for controlled comparative analysis (n=9). UTRGV’s Institute of Neuroscience (HION) served as study host, and its’ facilities aided in data capture for both sessions, baseline and post-2 months. During the baseline session participants self-disclosed neurotoxin pre-exposure (e.g. pesticides, Agent Orange, heavy metals, insecticides). Study staff then collected outcomes related to mental acuity (SLUMS), PD-associated gait abnormalities (HY Scale), non-motor/motor experiences burdening daily life (MDS-UPDRS), and arm motor functionalities. Corticospinal excitability and neuroplasticity were evaluated using Transcranial Magnetic Stimulation (TMS) in both groups. Specifically, we applied TMS at varying intensities to the area of the brain dedicated to the first dorsal interosseus (FDI) to evaluate neuroplasticity. Motor evoked potentials (MEPs) were recorded from the FDI at each assessed TMS intensity.

Results: Multivariate Analysis of Covariance revealed statistically significant mean differences in %MEP for Amplitude MEP and Area MEP after controlling for age, gender, mental status, HY ratings, motor function, and pre-stimuli EMG activity, [Pillai’s Trace = 0.24, F(18, 1358) =10.6, partial eta² = 12%, p < .001]. Post-hoc ANOVA’s resulted statistically significant % MEP mean differences for EMG Area MEP, [F(9, 676) =18.0, partial eta² = 19%, p < .001], and for EMG Amplitude MEP, F(9, 676) =19.0, partial eta² = 20%, p < .001. HY ratings alone did not reveal statistical differences in mean EMG amplitude, p > .05, however, mean EMG Amplitude for % MEP 70-180 statistically fit a sigmoid model curve, F(1, 681) = 651.2, p < .001. The sigmoid model follows the specified equation, \[ y = \frac{1}{1 + e^{-(0.374 + 0.998t)}} \].

Conclusions: Our findings suggest potential clinical implications in PD conditions related to motor function, with specific relationships between HY ratings and sigmoid model insights into physiologically observed differences. Identified differences in Amplitude MEP and Area MEP highlight the importance of multivariate approaches to understanding MEP. Application of the present study can improve a variety of areas: e.g., physical therapy, neurotoxin regulation, even PD treatment. It can be speculated that variables such as age, gender, mental status, and pre-stimuli EMG activity should be carefully considered in future research on %MEP. Researchers should explore underlying mechanisms behind observed effects, interactions between variables, and clinical relevance of these findings. Specific implications may vary depending on the context of future research, e.g. characteristics of investigated populations, field of research (e.g., neurology, motor control, clinical rehabilitation), but nevertheless researchers should consider these conclusions in the broader context of existing literature and specific goals of investigation.
July 21, 2022

Kelsey Baker, Principal Investigator
Department: School of Medicine
Via Electronic Routing System

Dear Principal Investigator:

RE: APPROVAL FOR HUMAN SUBJECTS RESEARCH [IRB-22-0184], “Role of Neurotoxin Pre-Exposure on Parkinson’s Disease Progression and Neuroplasticity Changes”

The study reference above has been reviewed and approved on July 21, 2022.

Basis for approval: Expedited Categories 2, 4, and 7.

Approved number of subjects to be enrolled: 7.

This project is not subject to continuation review.

Recruitment and Informed Consent: You must follow the recruitment and consent procedures that were approved.

Modifications to the approved protocol: Modifications to the approved protocol (including recruitment methods, study procedures, survey/interview questions, personnel, consent form, or subject population), must be submitted to the IRB for approval. Changes should not be implemented until approved by the IRB.

Data retention: All research data and signed informed consent documents should be retained for a minimum of 3 years after completion of the study.
Closure of the Study: Please be sure to inform the IRB when you have completed your study, have graduated, and/or have left the university as an employee. A final report should be submitted for completed studies or studies that will be completed by their respective expiration date.

Cordially,

UTRGV Institutional Review Board

Office of Research Compliance

Brownsville • Edinburg • Harlingen