Cureus
Part of SPRINGER NATURE

Open Access
Abstract

Cureus

Early effect of Onabotulinum Toxin-A on EEG-based functional connectivity in patients with chronic migraine: a pilot study

Open Access
Abstract
Published 09/04/2024

Matteo Conti [1], Roberta Bovenzi [2], Maria Giuseppina Palmieri [1], Fabio Placidi [1], Alessandro Stefani [1], Nicola Biagio Mercuri [3], Maria Albanese [4]

1. Department of Systems Medicine, University of Rome “Tor Vergata”, Rome, ITA 2. Department of Systems Medicine, University of Rome “Tor Vergata", Rome, ITA 3. Department of Systems Medicine,, University of Rome “Tor Vergata”, Rome, ITA 4. Regional Referral Headache Center, Neurology Unit, University of Rome “Tor Vergata”, Rome, ITA

Corresponding author: Matteo Conti, matteoconti92@gmail.com

Categories: Pain Management
Keywords: onabotulinum toxin-a, chronic migraine (cm)

How to cite this abstract
Conti M, Bovenzi R, Palmieri M, et al. (September 04, 2024) Early effect of Onabotulinum Toxin-A on EEG-based functional connectivity in patients with chronic migraine: a pilot study. Cureus 16(9): a1300

Abstract

Background
Onabotulinum Toxin-A (OBTA) is indicated as a treatment of chronic migraine (CM). Several studies have shown the modulatory action of BTA on the central nervous system. However, research on migraine is limited.

Objective
In this pilot prospective cohort study, we aimed to evaluate, by means of high-density EEG (HD-EEG), the longitudinal changes in brain functional connectivity (FC) in adult CM patients treated with OBTA.

Methods
This study was conducted at the Neurology Unit of “Policlinico Tor Vergata”, Rome, Italy, and included 12 adult CM patients treated with OBTA and 15 healthy controls (HC). Patients underwent clinical scales at enrollment (T0) and at three months (T1) from the start of treatment. HD-EEG was recorded using a 64-channel system in CM patients at T0 and T1, and in controls (HC). A source reconstruction method was used to identify brain activity. FC in δ-θ-α-β-low-γ bands was analyzed using the weighted phase-lag index. FC changes between HCs and CM patients at T0 and T1 were then assessed, using cross-validation methods to estimate the reliability of the results.

Results
Compared to HCs, at T0 CM patients showed hyperconnected networks in δ (p=0.046, AUC [0.76 0.98], Cohen’s κ [0.65 0.93]) and β (p=0.031, AUC [0.68 0.95], Cohen’s κ [0.51 0.84]), mainly involving orbitofrontal, occipital, temporal pole and orbitofrontal, superior temporal, occipital, cingulate areas respectively, and hypoconnected network in α band (p=0.029, AUC [0.80 0.99], Cohen’s κ [0.42 0.77]), predominantly involving cingulate, temporal pole and precuneus. CM patients at T1, compared to T0, showed hypoconnected networks in δ band (p=0.032, AUC [0.73 0.99], Cohen’s κ [0.53 0.90]), and hyperconnected in α band (p=0.048, AUC [0.58 0.93], Cohen’s κ [0.37 0.78]), networks, involving the sensorimotor, orbitofrontal, cingulate, and temporal cortex.

Conclusions
These preliminary results showed that CM patients presented disrupted EEG-FC compared to controls that was restored by a single-session of OBTA treatment, suggesting a primary central modulatory action of BTA.

References

1. Becker WJ. Botulinum Toxin in the Treatment of Headache. Toxins, 2020.
2. Iyengar S, Ossipov MH, Johnson KW. The role of calcitonin gene-related peptide in peripheral and central pain mechanisms including migraine. Pain. 2017.
3. Altamura C, Brunelli N, Viticchi G, Salvemini S, Cecchi G, Marcosano M, et al. Quantitative and Qualitative Pain Evaluation in Response to OnabotulinumtoxinA for Chronic Migraine: An Observational Real-Life Study. Toxins (Basel). 2023;15(4).
4. Caleo M, Antonucci F, Restani L, Mazzocchio R. A reappraisal of the central effects of botulinum neurotoxin type A: By what mechanism? J Neurochem. 2009.
5. Skorobogatykh K, Van Hoogstraten WS, Degan D, Prischepa A, Savitskaya A, Ileen BM, et al.

Functional connectivity studies in migraine: What have we learned? Vol. 20, Journal of Headache and Pain. 2019.

6. Hok P, Veverka T, Hluštík P, Nevrlý M, Kaňovský P. The Central Effects of Botulinum Toxin in Dystonia and Spasticity. Toxins. 2021.