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Brak efektu tDCS (anoda F3/katoda Cpz) u pacjenta z ciężkimi, opornymi na leczenie halucynacjami cenestetycznymi

No effect of anodal F3/cathodal Cpz tDCS in a patient with severe treatment-refractory coenaesthetic hallucinations

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Streszczenie

W artykule przedstawiono opis przypadku 57-letniego pacjenta od ponad 20 lat chorującego na schizofrenię, z występującymi ciężkimi, opornymi na leczenie omamami cenestetycznymi, które są zlokalizowane w okolicy narządów płciowych. Ze względu na brak alternatyw terapeutycznych przeprowadzono serię zabiegów przezczaszkowej stymulacji prądem stałym, które były nakierowane na korę somatosensoryczną reprezentującą okolice narządów płciowych. Nasilenie objawów oceniano za pomocą Clinical Global Impression (CGI, Severity and Improvement), Positive and Negative Syndrome Scale (PANSS) oraz trzech skal wizualno-analogowych, oddzielnie dla następujących, charakterystycznych cech: „ogólny dyskomfort", „uczucie przebijania się jąder" oraz „ból". Po ukończeniu 3-tygodniowej serii zabiegów przezczaszkowej stymulacji prądem stałym nie uzyskano zmian między początkową a końcową oceną kliniczną.

Słowa kluczowe: schizofrenia, tDCS, halucynacje cenestetyczne

Abstract

This article presents a case report of a 57-year-old patient with chronic (>20 years) schizophrenia and severe treatment-refractory coenaesthetic hallucinations located within the genital area. Due to the lack of therapeutic alternatives, a course of transcranial direct current stimulation targeting the somatosensory cortex that represents the genital area was performed. The severity of symptoms was assessed using the Clinical Global Impression (CGI, Severity and Improvement), Positive and Negative Syndrome Scale (PANSS) and three visual-analogue scales, separately for the three distinctive features of "general discomfort", "ripping out", and "pain". After completing the three-week transcranial direct current stimulation course, there were no changes between the baseline and final clinical scores.

Keywords: schizophrenia, tDCS, cenesthetic hallucinations

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INTRODUCTION

Coenaesthetic hallucinations are a variant of somatic hallucinations (i.e. false sensations of things occurring in or to the body) that are visceral in origin. While the majority of coenaesthetic hallucinations are found in patients with schizophrenia, there are also a limited number of other neuropsychiatric causes reported, e.g. Parkinson's disease (treated with pergolide and levodopa) (Jiménez-Jiménez et al., 1997) or after stroke (Kato et al., 2006). A very good concise review of visceral hallucinations has been published by Kathirvel and Mortimer (2013). Transcranial direct current stimulation (tDCS) is a modern, safe, and effective method of non-invasive brain stimulation (NIBS). tDCS typically uses two electrodes (anode and cathode). tDCS results in lowering the resting potential of cortical neurons within the area of the cathode, which consequently have reduced probability of triggering a response to neuronal input. Typically, hallucinations are associated with sensory modality-specific activation in the cerebral areas which are involved in normal sensory processing (temporal cortex for auditory and occipital cortex for visual) (Weiss and Heckers, 1999). Consequently, tDCS of those modality-specific areas might reduce the severity of hallucinations originating in the overactive cortical regions. This effect has already been reported for visual (Koops and Sommer, 2017) and auditory (Kantrowitz et al., 2019) hallucinations. Recent meta-analyses on the use of tDCS for auditory hallucinations have shown the efficacy of tDCS (Yang et al., 2019), even if the symptoms did not responded to previous treatments (Jiang et al., 2022).

MATERIALS AND METHODS

We present a case report of a 57-year-old patient with chronic (>20 years) schizophrenia and severe treatment-refractory coenaesthetic hallucinations located within the genital area. The patient reported recurring, severe feelings that his testicles were being "ripped out" of his body and that his scrotum was so enlarged that it was hanging loosely between his knees. He suffered from a severe anxiety that his testicles and scrotum would completely detach from the body, and he would die as a consequence. This symptom had been present for many months prior to the current hospitalisation, making the patient unable to take care for his basic needs. In the past, he was medicated with the majority of available antipsychotics (with no significant improvement) and electroconvulsive therapy (also unsuccessfully). Due to the lack of therapeutic alternatives, we performed a course of tDCS targeting the somatosensory cortex that represents the genital area. During the treatment, the patient continued his medications (olanzapine 20 mg/day, clozapine 150 mg/day, mirtazapine 45 mg/day, lithium 250 mg/day, nd lorazepam 2 mg/day). The severity of symptoms was assessed using the Clinical Global Impression (CGI, Severity and Improvement), Positive and Negative Syndrome Scale (PANSS) and three visual-analogue scales, separately for the three distinctive features of "general discomfort", "ripping out", and "pain".

tDCS was performed using the DC-Stimulator PLUS (neuroCare, Germany). tDCS is not approved for the treatment of schizophrenia and has an experimental status. All stimulations were performed using 5 × 7 cm rubber electrodes placed in saline-soaked sponge pads (average volume of 0.9% saline). For all sessions, a current of 2.0 mA was applied, thus resulting in the current density of 0.57 A/m^2. The location (according to the 10–20 International System of Electrode Placement) of the anodal electrode was F3 (which corresponds to the left dorsolateral prefrontal cortex – DLPFC), while the cathode was placed at Cpz (corresponding to the location of the somatosensory cortex which represents the genital area). The duration of stimulation was 1,200 seconds (20 minutes) for all sessions, with ramp-in and ramp-out of 20 seconds both. The total number of tDCS sessions was 15 (one session per day, for three weeks, Monday to Friday, at 1:00 PM). The tDCS protocol was based on our previous experience with tDCS in auditory hallucinations and cognitive rehabilitation in schizophrenia. The tolerability of each session was evaluated by the patient using a standard protocol. Only mild tingling sensation was reported by the patient. In order to evaluate the electric field distribution, we generated two models using the SimNIBS v4.0.1 and MNI head model and the ROAST v3.0 and New York head model (MATLAB 2021a). The study protocol was approved by the Bioethics Commission of the Medical University of Lodz. The patient gave his informed consent to participate in the study. The tDCS procedure were performed in accordance with international guidelines (Lefaucheur et al., 2017).

RESULTS

After completing the three-week tDCS course, there were no changes between the baseline and final clinical scores. We concluded that the severity of coenaesthetic hallucinations neither improved nor deteriorated, and so did the patient's general psychopathology. Subjectively, the patient reported a slightly better mood and lowered anxiety directly after each tDCS session, but we observed similar effects after all previous interventions (electroconvulsive therapy, additional medication, additional psychological support, placebo).

Prior to tDCS and at the end of each week, we also recorded standard 19-channel resting electroencephalography (EEG). The EEG-processing pipeline [performed using NeuroAnalyzer toolbox (Wysokiński, 2023)] included filtering (high-pass filter at 0.5 Hz, notch filter at 50 Hz), common average referencing, epoching into 20-second epochs and visual rejection of epochs containing artifacts. There is just one report of the gamma-band oscillations in a patient with somatic hallucinations (Baldeweg et al., 1998). Therefore, we analyses the band power within the delta, theta,

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beta, alpha, and gamma ranges for F3, Cz and Pz locations before and after tDCS treatment. No differences were found after tDCS for any of the analysed ranges.

DISCUSSION AND CONCLUSIONS

To our knowledge, this is the first documented case of using tDCS for the treatment of severe treatment-refractory coenaesthetic hallucinations. We observed no clinical effects. This might be due to many factors, mostly to the patient's general treatment refractoriness regarding both pharmacological and non-pharmacological therapies. Since response to tDCS manifests in changes of the EEG spectrum (Schestatsky et al., 2013) (although there is large variability of reported effects), we hypothesise that there might be a connection between the lack of clinical efficacy and the absence of any detected EEG changes in our patient, although the cause remains unknown. No response to tDCS may result from medications [e.g. potent dopamine D2 blockers may reduce tDCS after-effects (Nitsche et al., 2012)], but the patient took no such antipsychotics.

In general, the literature on coenaesthetic hallucinations in schizophrenia is sparse. There are only two reports on the use of repeated transcranial magnetic stimulation (rTMS) for coenaesthetic hallucinations in the course of schizophrenia. In the first case, the authors used targeted (based on functional magnetic resonance imaging, fMRI) low-frequency (1 Hz) rTMS of the somatosensory cortex (Jardri et al., 2008). They reported a significant improvement which remained stable for at least eight weeks after the treatment. In the second case report, the authors also used low-frequency (1 Hz) rTMS over the anatomical spot equivalent to the somatosensory cortex (i.e. contralateral to the symptomatic side) (Nasser et al., 2017). They also reported a significant and stable improvement of the symptoms. It should be noted that in the latter report the initial use of high-frequency (10 Hz) stimulation led to the worsening of the symptoms. In general, low-frequency rTMS is equivalent to cathodal tDCS stimulation, so our approach, although using a different stimulation modality, is equivalent to that used in both reports.

The efficacy of rTMS may shed some light on the cause of absent tDCS effects in our case, as rTMS penetrates deeper into the brain compared with tDCS. The somatosensory representation of the genital area is located deeply in the longitudinal fissure. The spread of the electric current in tDCS is limited mostly to the superficial layers of the cortex, lying directly under the scalp and skull bone, and might therefore not reach the potentially hyperactive structures of the somatosensory cortex. In both reported rTMS cases, the patients exhibited symptoms associated with somatosensory areas located in more superficial cortical parts (upper extremities and abdomen, respectively). Thus, reaching the cortical representations of those sensations was more feasible using rTMS, which might be responsible for good clinical response. The lack of clinical response in our case might be due to the superficial spread of the electric current, though this is in contradiction with computer models, as well as two other available reports, where the stimulation worked.

Conflict of interest

The authors do not report any financial or personal connections with other persons or organizations that could negatively affect the content of this publication and claim authorship rights to this publication.

Author contributions

Original concept of study: AW. Collection, recording and/or compilation of data: KSW. Analysis and interpretation of data: KSW, AW. Writing of manuscript: AW. Final approval of manuscript: AW.

Piśmiennictwo

Baldeweg T, Spence S, Hirsch SR et al.: γ-band electroencephalographic oscillations in a patient with somatic hallucinations. Lancet 1998; 352: 620–621.

Jardri R, Pins D, Thomas P: A case of fMRI-guided rTMS treatment of coenesthetic hallucinations. Am J Psychiatry 2008; 165: 1490–1491.

Jiang WL, Cai DB, Sun CH et al.: Adjunctive tDCS for treatment-refractory auditory hallucinations in schizophrenia: a meta-analysis of randomized, double-blinded, sham-controlled studies. Asian J Psychiatr 2022; 73: 103100.

Jiménez-Jiménez FJ, Ortí-Pareja M, Gasalla T et al.: Cenesthetic hallucinations in a patient with Parkinson's disease. J Neurol Neurosurg Psychiatry 1997; 63: 120.

Kantrowitz JT, Sehatpour P, Avissar M et al.: Significant improvement in treatment resistant auditory verbal hallucinations after 5 days of double-blind, randomized, sham controlled, fronto-temporal, transcranial direct current stimulation (tDCS): a replication/extension study. Brain Stimul 2019; 12: 981–991.

Kathirvel N, Mortimer A: Causes, diagnosis and treatment of visceral hallucinations. Prog Neurol Psychiatry 2013; 17: 6–10.

Kato Y, Muramatsu T, Kato M et al.: Cortical reorganization and somatic delusional psychosis: a magnetoencephalographic study. Psychiatry Res 2006; 146: 91–95.

Koops S, Sommer IEC: Transcranial direct current stimulation (tDCS) as a treatment for visual hallucinations: a case study. Psychiatry Res 2017; 258: 616–617.

Lefaucheur JP, Antal A, Ayache SS et al.: Evidence-based guidelines on the therapeutic use of transcranial direct current stimulation (tDCS). Clin Neurophysiol 2017; 128: 56–92.

Nasser A, Batista JS, Brandão P et al.: A case of coenesthetic hallucinations treated with low-frequency repetitive transcranial magnetic stimulation. Brain Stimul 2017; 10: 845–846.

Nitsche MA, Müller-Dahlhaus F, Paulus W et al.: The pharmacology of neuroplasticity induced by non-invasive brain stimulation: building models for the clinical use of CNS active drugs. J Physiol 2012; 590: 4641–4662.

Schestatsky P, Morales-Quezada L, Fregni F: Simultaneous EEG monitoring during transcranial direct current stimulation. J Vis Exp 2013; (76): 50426.

Weiss AP, Heckers S: Neuroimaging of hallucinations: a review of the literature. Psychiatry Res 1999; 92: 61–74.

Wysokiński A: NeuroAnalyzer. Zenodo. 2023. Available from: https://doi.org/10.5281/zenodo.7985829.

Yang F, Fang X, Tang W et al.: Effects and potential mechanisms of transcranial direct current stimulation (tDCS) on auditory hallucinations: a meta-analysis. Psychiatry Res 2019; 273: 343–349.