Brain Stimulation 12 (2019) 794–796

Contents lists available at ScienceDirect

Brain Stimulation

journal homepage: http://www.journals.elsevier.com/brain-stimulation

Psychogenic non-epileptic seizures treated with guided transcranial direct current stimulation: A case report

Keywords:
PET-Scan
tDCS
Psychogenic non-epileptic seizure
Dissociation
Somatoform disorder
Trauma

A B S T R A C T

Introduction: Psychogenic non-epileptic seizures (PNES) are paroxysms of either altered subjective or objective manifestations that may mimic epileptic seizures (ES), without abnormal neuronal epileptiform activity. In this report, we present the case of a 39-year-old woman with PNES and functional movement disorders, who was successfully treated with neuro-guided transcranial direct current stimulation (tDCS).

Methods: We used a PET-guided tDCS approach, as a hypometabolism of the frontal region was revealed by FDG TEP scan. TDCs was performed 5 days/week, 2 times/day, during 3 weeks. All clinical manifestations were reported in a seizure diary. We also assessed dissociation, depression, alexithymia, psychotraumatic scales, and involuntary movements.

Results: The treatment was followed by a decrease of both psychogenic involuntary movements and PNES at 5 weeks. At the same time, PTSD symptoms, dissociative symptoms, depression and alexithymia improved.

Conclusion: PET-scan and tDCS seems to be promising tools for the evaluation and treatment of PNES in clinical practice, and may have a specific role on dissociative symptoms.

Introduction

Psychogenic non-epileptic seizures (PNES) are paroxysms of either altered subjective or objective manifestations that may mimic epileptic seizures (ES), without abnormal neuronal epileptiform activity. The prevalence of PNES is about 2–33 per 100 000, making it a significant neurological condition [1]. In this report, we present the case of a 39-year-old woman presenting with PNES, who was successfully treated with neuro-guided transcranial direct current stimulation (tDCS).

Case report

A 39-year-old woman was admitted to our Psychiatry Department after suicide attempt. She had a history of suicide attempt when she was 15 and she was taking cannabis (daily) and amphetamines every week. She had no other medical condition and was not taking any medication. She had documented non-epileptic seizures for about 1 year, diagnosed by a clinician experienced in diagnosis of seizure disorders, showing typical clinical manifestations of PNES, while no epileptiform activity on video EEG. She also had permanent myoclonic and dystonic unintentional movements of her head, neck and arms, associated with dysarthria (Abnormal Involuntary Movement Scale (AIMS) = 32), that couldn't be explained by a neurological disorder. All clinical manifestations were reported in a seizure diary. Two types of PNES were noticed. The first type, "generalized" PNES (G-PNES), corresponded to disorganized movements of her face, arms and legs, sometimes associated with opisthotonus, usually lasted more than 30 minutes, and occurred 5 times/week. The second type, "focalized" PNES, (F-PNES), corresponded to disorganized movements of only one arm or leg and usually lasted a few seconds and occurred 4 times/week. She never had loss of consciousness during seizures. Both seizures could be triggered by intermittent photic stimulation or emotional stress. She had no history of bipolar disorder (Mood Disorder Questionnaire < 7). She had depressive symptoms fluctuating with seizures (MADRS = 20) without the full criteria of a major depressive episode. She had a history of trauma (witnessing her boyfriend who died from overdose) associated with symptoms of PTSD (PTSD Checklist Scale (PCLS) = 68). We found symptoms of dissociation during and between seizures (Somatoform Dissociation Questionnaire (SDQ) = 45, Dissociative Experiences Scale (DES) = 40%, Cambridge Depersonalization Scale (CDS) = 76). She also had signs of alexithymia (Toronto Alexithymia Scale (TAS) = 68) and the Personality Disorder Questionnaire was also consistent with a Borderline Personality Disorder. In the months preceding her hospitalization, the patient didn't improve with at least two well-conducted antidepressants (treatment resistant depression at stage IV of the Thase and Rush classification) [2] and she refused to begin a psychotherapeutic treatment focused on PNES. All laboratory results and brain MRI were normal. PNES were severe and debilitating, and she accepted a neuromodulation-based treatment. As knowledge about neural basis of PNES are scarce, we used [18F]-Fluorodesoxyglucose Positron

https://doi.org/10.1016/j.brs.2019.01.019
1935-861X/

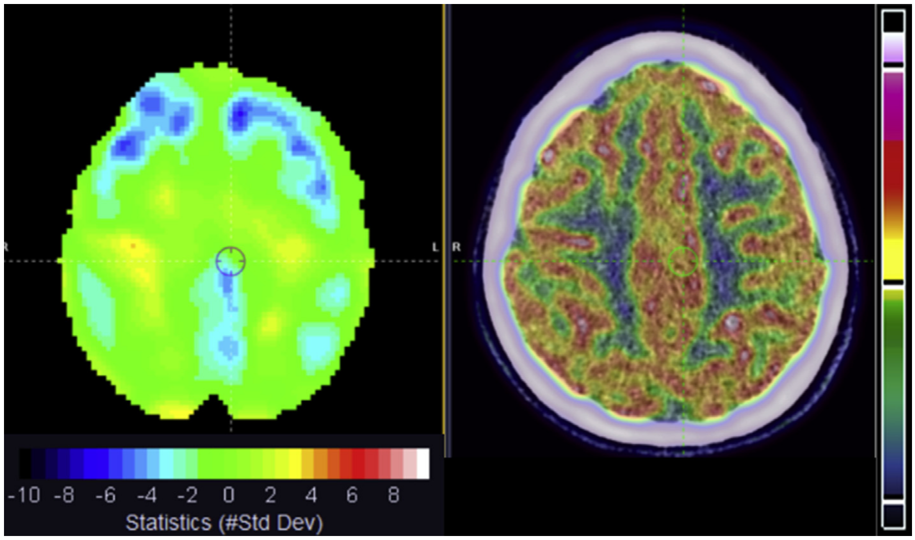

Fig. 1. a) PET) brain scan obtained 30 min after injection of 185 MBq of (18F)-Fluorodesoxyglucose on Biograph mCT 16 (Siemens MS, Knoxville, USA) before stimulation b) Database comparison results in standard deviation of the mean with a significant decrease in metabolism of the anterior associative cortical areas, interesting the dorsolateral prefrontal cortex and to a lesser extent prefrontal and orbitofrontal cortex (Sceenium, Siemens).

Emission Tomography (FDG-PET) brain scan to select a target of stimulation.

The FDG-PET revealed a hypometabolism of the anterior associative cortical areas, involving the bilateral dorsolateral prefrontal cortex and to a lesser extent the bilateral orbitofrontal cortex (Fig. 1). We thus used a PET-guided tDCS approach by placing the anode on F3, and cathode on FP2, 5 days/week, 2 times/day, for 3 weeks. tDCS has been applied using the following protocol: current intensity 2 mA, electrode size = 35 cm^2 and stimulation duration = 30 minutes. We followed this protocol in order to also potentially treat depressive symptoms at the same time. This treatment was followed by a progressive decreasing of involuntary movements that begins at the end of week 2 (AIMS = 12 (- 63%) after 5 weeks), GNES (1/week after 5 weeks (−80%)) and FNES (1/week (−75%) after 5 weeks). At the same time, PTSD symptoms (PCLS = 52 (−31%) and dissociative symptoms (SDQ = 32 (- 29%); DES = 34% (- 15%) and CDS = 59 (- 22%) improved. TAS score was 62 (- 8%), and MADRS score was 16 (−20%). We have then empirically added one supplementary week of treatment, because of incomplete response. Improvement of PNES remains stable over 8 weeks.

Discussion

We describe a case of a 39-year-old woman presenting with PNES, successfully treated with neuro-guided tDCS. An improvement of her dissociative symptoms was also noted, which is in line with the hypothesis that the mechanism of dissociation is pivotal in the pathophysiology of PNES [3]. Interestingly, even if high-frequency repetitive transcranial magnetic stimulation (rTMS) over the right temporo-parietal junction (rTPJ) has been previously tested in a case series [8], knowledge about the neural basis of PNES does not seem sufficient to opt for a consensual target of stimulation. On one hand, fMRI studies are scarce with small sample size showing broad networks alterations beyond the right TPJ, including alterations in functional connectivity in brain regions associated with attention and regulatory processes, memory, emotion processing, consciousness of the self and the environment and sensory and motor function [4]. On the other hand, there is only one study using PET-scan in PNES showing a hypometabolism within the right inferior parietal and central region, and within the bilateral anterior cingulate cortex [5]. The case presented here is the first report of the use of guided-neuromodulation to treat PNES.

We acknowledge that placebo effect is usually important in the treatment of conversion disorders [6], and it may have mediated the response to treatment. Moreover, we cannot exclude that the PET-scan hypometabolism was associated to depressive symptoms. Another limitation could be that tDCS modulates neuronal excitability in a relatively wider area than the specific site where the anode is placed.

One mechanism of tDCS may be the modulation of dissociative symptoms, as shown by the improvement of dissociative scales after tDCS. Dissociative symptoms have indeed been associated to an increased functional connectivity between the prefrontal cortex and other brain areas such as amygdala [7], and tDCS could have modulated these networks.

Future studies should also try to understand the mechanism of tDCS when treating PNES. Neuroimaging functional magnetic resonance imaging data have indeed suggested that brain regions associated with psychogenic disorders, such as the dorsolateral prefrontal cortex and anterior cingulate [8], also mediate placebo effects for pain [9] and for depression [10]. Randomized controlled trials should also be performed to assess the efficacy of tDCS in the treatment of PNES.

Conclusion

PET-scan and tDCS are promising tools for the assessment and treatment of PNES in clinical practice. These results need to be replicated in a larger sample of patients with PNES.

Contributors' statement page

Arnaud Leroy managed the case, drafted the initial manuscript, and reviewed and revised the manuscript.

Martin Beigné managed the case, drafted the initial manuscript, and reviewed and revised the manuscript.

Ali Amad managed the case, reviewed and revised the manuscript.

Grégory Petyt managed the case, reviewed and revised the manuscript.

Philippe Derambure managed the case, reviewed and revised the manuscript.

Guillaume Vaiva reviewed and revised the manuscript.

All authors approved the final manuscript as submitted and agreed to be accountable for all aspects of the work.

Conflicts of interest

None.

Funding source

None.

Financial disclosure

None.

Acknowledgments

The authors would like to thank Dr. Anaïs Vaglio (Lille) and C. Hingray (Nancy) for their help in managing the case. We would also like to thank the multimedia dpt. of the Lille school of medicine (Univ. Lille), especially Mr. Edouard Latour, for editing the movie (available on resquest).

Appendix A. Supplementary data

Supplementary data to this article can be found online at https://doi.org/10.1016/j.brs.2019.01.019.

References

[1] Benbadis SR, Allen Hauser W. An estimate of the prevalence of psychogenic non-epileptic seizures. Seizure 2000;9:280–1.
[2] Thase ME, Rush AJ. When at first you don't succeed: sequential strategies for antidepressant nonresponders. J Clin Psychiatr 1997;58(Suppl 13):23–9.
[3] Hingray C, Biberon J, El-Hage W, de Toffol B. Psychogenic non-epileptic seizures (PNES). Rev Neurol (Paris) 2016;172:263–9.
[4] Mcsweeney M, Reuber M, Levita L. Neuroimaging studies in patients with psychogenic non-epileptic seizures: a systematic meta-review. NeuroImage Clin 2017;16:210–21.
[5] Arthuis M, Micoulaud-Franchi JA, Bartolomei F, McGonigal A, Guedj E. Resting cortical PET metabolic changes in psychogenic non-epileptic seizures (PNES). J Neurol Neurosurg Psychiatry 2015;86:1106–12.
[6] Rommelfanger KS. The role of placebo in the diagnosis and treatment of functional neurologic disorders. Handb Clin Neurol 2016;139:607–17.
[7] Nicholson AA, Rabellino D, Densmore M, Frewen PA, Paret C, Kluetsch R, et al. The neurobiology of emotion regulation in posttraumatic stress disorder: amygdala downregulation via real-time fMRI neurofeedback. Hum Brain Mapp 2017;38:541–60.
[8] Nowak DA, Fink GR. Psychogenic movement disorders: aetiology, phenomenology, neuroanatomical correlates and therapeutic approaches. Neuroimage 2009;47:1015–25.
[9] Wager TD, Scott DJ, Zubieta J-K. Placebo effects on human mu-opioid activity during pain. Proc Natl Acad Sci U S A 2007;104:11056–61.
[10] Mayberg HS, Silva JA, Brannan SK, Tekell JL, Mahurin RK, McGinnis S, Jerabek PA. The functional neuroanatomy of the placebo effect. Am J Psychiatry 2002;159:728–37.

Arnaud Leroy*
CHU Lille, Hôpital Fontan, Department of Psychiatry, F-59000, Lille, France

Univ. Lille, CNRS UMR-9193, SCALab - Sciences Cognitives et Sciences Affectives, France

Martin Beigné
CHU Lille, Hôpital Fontan, Department of Psychiatry, F-59000, Lille, France

Grégory Petyt
CHU Lille, Nuclear Medicine Department, F-59037, Lille Cedex, France

Philippe Derambure
Neurophysiologie Clinique Lille University Hospital Inserm U1171, Lille, France

Guillaume Vaiva
CHU Lille, Hôpital Fontan, Department of Psychiatry, F-59000, Lille, France

Univ. Lille, CNRS UMR-9193, SCALab - Sciences Cognitives et Sciences Affectives, France

Ali Amad
CHU Lille, Hôpital Fontan, Department of Psychiatry, F-59000, Lille, France

Univ. Lille, CNRS UMR-9193, SCALab - Sciences Cognitives et Sciences Affectives, France

Department of Neuroimaging, Institute of Psychiatry, Psychology and Neuroscience, King's College London, London, UK

* Corresponding author. Service de psychiatrie adulte, CHU de Lille, 59037, Lille cedex, France.
E-mail address: arnaud.leroy@chru-lille.fr (A. Leroy).

10 January 2019
Available online 31 January 2019