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Cognitive deficits and emotion regulation strategies in patients with psychogenic nonepileptic seizures: A task-switching study

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ABSTRACT

This study examined the task-switching ability and emotion regulation strategies in 72 patients with psychogenic nonepileptic seizures (PNES) and 72 healthy individuals, where participants categorized emotion and age dimensions among faces. Results demonstrated cognitive impairment in terms of the interrupted ability to switch between emotion and nonemotion face categorizations in patients with PNES. In contrast, healthy individuals exhibited efficient switching between these face categorizations. In patients with PNES, there was an asymmetric relationship between emotion and age tasks, while this asymmetry was absent in the healthy group. The results demonstrated that patients with PNES used expressive suppression to regulate their emotions more frequently than the control group. On the other hand, patients with PNES less frequently reappraised their cognitions than healthy individuals. Switching deficits in patients with PNES were positively correlated with expressive suppression but were negatively correlated with cognitive reappraisal. This is the first study demonstrating the presence of switching deficits in terms of inferior cognitive control of emotion in patients with PNES as compared to healthy individuals. The switching deficits are associated with emotion regulation strategies. These findings suggest that emotion regulation strategies are significant markers of switching deficits in patients with PNES.

1. Introduction

Psychogenic nonepileptic seizures (PNES) can be defined as involuntary behaviors due to psychological and emotional disturbances. They are very similar to epileptic seizures, but whereas the causes of. The causes of psychogenic nonepileptic seizures are psychological and emotional disturbances, epileptic seizures have a neurologic origin [1]. Psychogenic nonepileptic seizures are not characterized by electrical discharge associated with epileptic seizures and are known as nonepileptic attack disorders. Certain features are usual in PNES but are uncommon in epileptic seizures: (i) tongue biting usually at the tip of the tongue, (ii) seizure duration of more than 2 min with a gradual onset, (iii) closed eyes during the seizure, and (iv) side-to-side head movements. Rare features in PNES include incontinence, severe tongue biting, and automatic complex movements [2,3].

Patients with PNES suffer from impairment in brain areas which are responsible for emotion regulation, executive control process, and movement, such as the prefrontal cortex, insula, inferior frontal gyrus, parietal cortex, and central sulcus. As a result, patients have unstable cognitive, emotional, and attentional systems [4]. Patients with PNES process emotional information on a preconscious level. Neurocognitive data revealed that patients with PNES suffer from impairment in working memory and attentional deficit. In a masked emotion Stroop task, color-naming latencies for backwardly masked faces were measured. Patients with PNES displayed a positive attentional bias (i.e., slower color naming) to angry faces. In contrast, healthy individuals responded faster to angry faces. This result showed vigilance to expressions of emotions in patients with PNES [5]. Similarly, patients with PNES reported more emotional intensity to standard affective pictures and showed general emotion regulation difficulties. This result demonstrated that patients with PNES experienced intense emotions and negative emotional behavior [6].

Patients with PNES displayed lower global cognitive performance and higher dissociation scores than healthy individuals. The resting state fMRI showed a strong connectivity between areas associated with emotion regulation (i.e., insula), executive functions (i.e., inferior frontal gyrus and parietal cortex), and movement, such as the precentral sulcus, in patients with PNES. The strong functional connectivity between brain areas which monitor emotion, executive control, and movement was associated with the tendency to dissociate. Such an abnormal connectivity forms the basis for a neurophysiological correlate for underlying dissociation in patients with PNES, where emotion interferes with executive control. As a result, an altered motor activity appears which resembles an epileptic seizure [7]. Patients with PNES showed impaired neuropsychological performance on measures of attention, concentration, memory, verbal abilities, abstract reasoning, concept formation, etc. because of dysfunctions in the frontal lobe, a brain area which is primarily responsible for executive functions [8]. Patients with PNES demonstrated deficiency across a broad range of neuropsychological domains, specifically in attention and working memory.

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Attentional deficits were influenced by emotional distress in patients with PNES [9].

The modern concept of stress and health was influenced by Freud who stated that unresolved emotional distress causes somatic symptoms. Psychogenic nonepileptic seizure is one of those somatic symptoms [10]. Research suggests that patients with PNES lack coping strategies to deal with their emotional impairment, which may lead to suicidal ideation, irritated behavior, embarrassment, feelings of dependence [11], high expression of anger [12], emotion dysregulation [13], and external locus of control [14].

Emotion regulation is essential for mental health. People use different strategies to regulate emotion. Cognitive reappraisal and emotion suppression are common strategies used to control/maintain the emotion. Cognitive reappraisal means how a person perceives the situation in a way that he/she alters the emotional impact of the situation. Expressive suppression means to hide the external signs of internal feelings. The deliberate hiding of expression, an escape from sentiments, feelings, recollections, and other personal disturbing affairs, leads to different psychological and behavioral impairments [15]. Individuals who frequently hide their feelings and emotions suffer from decreased memory functioning and use less problem-solving strategies [16]. Suppression decreases social interaction and interpersonal communication and also has a negative correlation with human well-being [17]. Inhibiting positive and negative emotions increases sympathetic activations of the cardiovascular system and reduces cognitive performance [18]. Cognitive reappraisal strategy involves two parts: (i) awareness of the person's negative response and (ii) understanding of the situation as a way to decrease the intensity of negative response [19]. Functional magnetic resonance imaging (fMRI) data suggest that gray matter volume in different brain areas is involved in emotion regulation strategies. Cognitive reappraisal is associated with gray matter volume in the left amygdala. On the other hand, expressive suppression is related with gray matter volume in the paracingulate cortex and medial prefrontal cortex (PFC). Thus, larger volumes of the medial PFC and paracingulate cortex are involved in the regulation of emotion-expressive behavior, and the amygdala plays an important role in cognitive reappraisal [20]. Emotion regulation strategies decrease the experience and behavior related with negative emotion. In an emotion-generative process, reappraisal comes first and results in an early response of the PFC and a decrease in amygdala and insular response. On the other hand, suppression produces late PFC response but an increased amygdala and insular response [21]. Psychogenic nonepileptic seizures are characterized by MRI abnormalities, epileptiform EEG changes, and neuropsychological deficits [22]. The pathophysiological model suggests that the brain areas of patients with PNES involved in emotion regulation and sensorimotor and cognitive processes have an altered connection and that PNES are supported by an unbalanced cognitive–emotional attention system [23]. There is a possibility that patients with PNES deploy emotion regulation strategies in a modified pattern compared to healthy individuals. A differential usage of emotion regulation strategies could strengthen cognitive deficits in patients with PNES. Here, we were interested to examine whether emotion suppression and cognitive reappraisal facilitate cognitive inflexibility in patients with PNES.

1.1. The present study

Epidemiological studies [24] stated that PNES had a high prevalence rate all over the world. Numerous studies which suggest that PNES are characterized by cognitive impairment [25]. However, none of these studies has yet addressed cognitive dysfunctions, specifically switching deficits in relation to emotion regulation, in patients with PNES. The present research was a preliminary attempt to compare the switching ability of patients with PNES to that of healthy individuals with particular reference to face categorization tasks.

The following hypotheses were tested in the study:

1. Patients with PNES would show asymmetric switch costs (i.e., larger for the age task than the emotion task) between face categorization tasks. In contrast, healthy controls would exhibit a symmetric cost for emotion and age dimensions of faces.
2. Switch costs would have a positive relationship with expressive suppression in patients with PNES.
3. Switch costs would have a negative relationship with cognitive reappraisal in patients with PNES.

2. Methods

2.1. Participants

From March 2013 until September 2013, 72 patients with PNES who were contacted from Services and Jinnah Hospital volunteered for the study. The inclusion criteria for the group with seizures were as follows: patients should (a) be aged 18 to 35 years; (b) have a diagnosis of PNES according to DSM-IV [26], whether the diagnosis was achieved on the basis of clinical observation or seizure history; (c) have a frequency of at least 2 seizures before their participation in the study; and (d) do not have any type of epileptic seizures. Seventy-two healthy individuals (controls) were contacted with the help of an advertisement through brochures distributed in the University of Punjab. The inclusion criteria for the healthy control group were as follows: individuals should (a) be aged 18 to 35 years, (b) have no signs or symptoms of psychological and mental disorders, (c) have no signs of any neurological disease, and (d) not be using any medication. Patients and controls were matched on the basis of age, gender, education, and economic status.

2.2. Measures

2.2.1. Depression Anxiety and Stress Scale [27]

The Depression Anxiety and Stress Scale (DASS-42) was originally developed by Lovibond and Lovibond in 1995 [27]. It can be scored on a 4-point Likert scale of 0–3; 0 indicates “not apply to me”, and 3 indicates “completely apply”. Each subscale – depression, anxiety, and stress – consists of 14 items and can be scored by adding the score of those items which are relevant to that specific scale. The score of these three scales can be further categorized into normal, mild, moderate, and severe levels. The Depression Scale measures gloominess and cognitive problems. The Anxiety Scale evaluates the individual's experience of nervousness and impact of anxiety on the body. The Stress Scale measures the extent of relaxation and anxious arousal. Scores on depression are categorized as normal = 0–9, mild = 10–13, moderate = 14–20, and severe = 21–27, while anxiety scores are categorized as normal = 0–7, mild = 8–9, moderate = 10–14, and severe = 15–19. Stress scores are also divided into normal = 0–14, mild = 15–18, moderate = 19–25, and severe = 26–33. The Depression Anxiety and Stress Scale is strongly correlated with the Beck Anxiety Inventory (0.81) and Beck Depression Inventory (0.74). Cronbach's alpha is 0.96, 0.89, and 0.93 for depression, anxiety, and stress, respectively [28].

2.2.2. Emotion Regulation Questionnaire [29]

The Emotion Regulation Questionnaire measures an individual's capacity to assess how the individual regulates his/her emotions in stressful situations and daily life. This scale can be categorized into two subscales: (a) cognitive reappraisal and (b) emotion suppression. *Cognitive reappraisal* is the subcategory of the emotion regulation scale which measures how a person positively regulates or expresses his/her emotions to reduce psychological impact of the current situation. The scale consists of 6 items (1,3,5,7,8,10). *Emotion suppression* means to consciously hide or conceal uncomfortable feelings or thoughts in a more adaptable way. The scale consists of 4 items (2,4,6,9). The Emotion