Brief report

Exploring the affective component of pain perception during aversive stimulation in borderline personality disorder

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A B S T R A C T

In a pilot study, affective components of pain were assessed using repetitive peripheral magnetic stimulation (rPMS) in patients with borderline personality disorder and healthy controls. Significant differences in pain thresholds and in affective components of pain between both groups were found. rPMS was well tolerated and suitable for assessing pain.

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1. Introduction

Non-suicidal self-injury (NSSI) is one of the core symptoms in borderline personality disorder (BPD) (Zanarini et al., 2008). It occurs with the intention to counteract dissociative state, aversive inner tension, the sensation of emptiness or to punish oneself (Brown et al., 2002). About 70% of BPD patients report attenuated pain perception during NSSI (Leibenluft et al., 1987). Pain threshold (PT) in BPD patients with NSSI has shown to be higher compared to controls, even in the absence of distress (Bohus et al., 2000; Schmahl et al., 2006). The origin of this pain attenuation is not fully understood. As afferent sensory input, it may be related to differences in cognitive and emotional components.

Previous investigations lack to assess the affective component of pain perception during aversive stimuli (Lenzenweger and Pastore, 2007). Therefore, in our pilot study, different components of pain processing in BPD patients with NSSI and controls were assessed by using repetitive peripheral magnetic stimulation (rPMS) (Barker et al., 1985). We aimed at investigating whether cutaneous sensation, emotional valence and arousal level during aversive stimulation differ between BPD patients and controls and whether PT level is correlated with NSSI motivation or dissociative states.

2. Methods

2.1. Participants

Ten women with BPD (according to Diagnostic and Statistical Manual for mental disorders, fourth edition (DSM-IV)) with recurrent NSSI from the Psychiatry Department of the University of Ulm, Germany, and eight healthy age-matched control women took part in the study (all right-handed, mean age 31.2±8.1 and 30.0±4.4, respectively). The Structured Clinical Interview for DSM-IV (German version, Wittchen et al., 1997) and the Brief Psychiatric Rating Scale (Overall and Gorham, 1962) were administered to all participants for the diagnosis of the major Axis I and II disorders. NSSI was assessed by the Ottawa Self-Injury Inventory (OSI) (German version, Nixon and Cloutier, 2005). All patients committed NSSI at least once per week during the preceding 6 months. Dissociative level was evaluated in all participants using the Dissociative State Scale (Stiglmayr et al., 2001). Patients were on stable medication 4 weeks before rPMS (supplementary information (S) Table 1). Exclusion criteria were serious medical illness, substance abuse in the last 3 months and psychotic disorders. Controls were free of major medical or psychiatric illness, and without a history of psychiatric disorders. After complete description of the study, written informed consent was obtained from participants.

2.2. Study design

Participants sat in a comfortable chair, wearing headphones and earplugs to reduce acoustic artefacts from magnetic pulses. The non-dominant arm rested extended on a table. A circular parabolic coil (MMC-140 MacVenture, 140 mm, 33 kT s⁻¹) was placed in the palm, with the handle pointing to the opposite side of the arm. Mentioned coil and 1-s bursts at 25 Hz (stimulator: MagPro-X100) were chosen to provoke aversive sensation. The experiment was performed on 2 consecutive days. The first step in each day aimed at establishing the individual PT. Single bursts of rPMS every 15 s were delivered without burst on the non-dominant arm.

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starting at 10% of the maximum intensity of stimulator output and increased by 10% in each trial. Immediately after each burst, participants evaluated the degree of pain experience. Once they considered the burst as ‘painful’, PT was established at the corresponding intensity.

After the establishment of the individual PT each day, 50 bursts (25 Hz, 1 s) of rPMS (every 15 s) were randomly delivered at five different intensities, ranged from the PT level (maximal intensity = 5) downwards in steps of 10% (subthreshold intensities = 4–1). Immediately after each burst, subjects answered three visual analogue scales (range: 1–9).

They evaluated cutaneous sensation during stimulation (from ‘no pain at all’ = 1 to ‘very painful’ 9 (scale 1)), emotional valence of stimulation (from ‘pleasant’ to ‘very unpleasant’ (scale 2)) and arousal level (from ‘I feel very calm’ to ‘I feel an unbearable tension’ (scale 3)). Stimulations were performed by the same researcher (LCM), and participants were blind to the intensity. All procedures were approved by the Ethics Committee of the University of Ulm, and conform to the recent version of the Declaration of Helsinki.

2.3. Data analysis

Analysis of variance (ANOVA) for PT was carried out and its correlations with OSI Scores (NSSI motivation) were calculated in BPD patients (see Supplements S.). Components of pain (scales 1, 2 and 3) were analysed with repeated measures ANOVA (factor group (two-levels) and intensity (five-levels)). Statistical analysis was performed using STATISTICA 8.0. Level of significance was P < 0.05.

3. Results

ANOVA revealed significantly higher PT in BPD patients as compared with controls with a high intra-subject repeatability (S, Fig. 1). In BPD, significant positive correlations between PT and motivation of NSSI were found; no correlation was found between PT and dissociative state (S).

Regarding cutaneous sensation, emotional valence and arousal level during painful stimulation ANOVA revealed a significant effect of intensity in the three scales (F(4,59) = 153.6, P < 0.0001; F(4,52) = 10.96, P < 0.0001; and F(4,52) = 21.75, P < 0.0001, respectively). No group effect was found (F(1,16) = 1.5, P = 0.238; F(1,16) = 0.187, P = 0.676; and F(1,16) = 0.05, P = 0.824, respectively). A significant group x intensity interaction was found in all three scales (F(4,64) = 4.83, P = 0.001; F(4,64) = 6.6, P = 0.0001; and F(4,64) = 5.710, P = 0.0005, respectively). The increase in score values was steeper in controls compared to BPD patients (Fig. 1). No subject abandoned the study and no BPD patient complained of worsening of symptoms after rPMS.

4. Discussion

This is the first report on rPMS in the assessment of affective components of pain perception during aversive stimuli in BPD with NSSI and healthy controls. We found that although intensities applied were randomised, they were similarly discriminated by all participants (scale-1). Increasing stimulation intensity led to more aversion and higher arousal levels in controls during rPMS. By contrast, in BPD patients, responses remained almost unchanged among intensities (scale-2 and -3).

Furthermore, we found higher PTs in BPD patients compared with controls and intra-subject variability measured on both the days was low. Our data confirm and extend previous evidence of altered PT in BPD patients using other methods (Russ et al., 1992; Schmahl et al., 2006; Ludäscher et al., 2007). PT correlated positively with motivational factors of NSSI reported, indicating a preponderant role of emotional processes in pain perception. Our data strengthen findings using functional neuroimaging, showing BPD patients to have alterations in regions related to the affective response to pain (Schmahl et al., 2006). Some antidepressants (e.g., duloxetine and venlafaxine) have analgetic properties and may account for group differences. However, no patient in our study was medicated with these antidepressants. Although patients showed higher dissociative state than controls, no correlation between PT and dissociation was found. Further studies with larger sample sizes, including unmedicated patients and psychiatric controls, would be desirable. rPMS allows an accurate adjustment of parameters that modulate pain perception (i.e., bursts-length and intensity); it was suitable and well tolerated for inducing aversive stimuli. No relevant side effects were observed. Therefore, rPMS could help to further investigate the interplay between sensory and evaluative components of pain.

Supplementary data to this article can be found online at doi: 10.1016/j.psychres.2010.07.050.

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