Available online at www.sciencedirect.com
ScienceDirect
Psychiatry Research 150 (2007) 265–275
PSYCHIATRY RESEARCH
www.elsevier.com/locate/psychres

Psychophysiological ambulatory assessment of affective dysregulation in borderline personality disorder

Ulrich W. Ebner-Priemer [a,*], Stacy S. Welch [b], Paul Grossman [c], Thomas Reisch [d], Marsha M. Linehan [e], Martin Bohus [a]

[a] *Department of Psychosomatic Medicine and Psychotherapy, Central Institute of Mental Health, Postfach 122120, 68072 Mannheim, Germany*
[b] *Evidence Based Treatment Centers of Seattle, Seattle WA, USA*
[c] *Division of Psychosomatic Medicine, Department of Internal Medicine, University of Basel Hospital, Basel Switzerland*
[d] *University Hospital of Social and Community Psychiatry, Bern, Switzerland*
[e] *Department of Psychology, University of Washington, Seattle WA, USA*

Received 6 May 2005; received in revised form 28 November 2005; accepted 21 April 2006

Abstract

Many experts now believe that pervasive problems in affect regulation constitute the central area of dysfunction in borderline personality disorder (BPD). However, data is sparse and inconclusive. We hypothesized that patients with BPD, in contrast to healthy gender and nationality-matched controls, show a higher frequency and intensity of self-reported emotions, altered physiological indices of emotions, more complex emotions and greater problems in identifying specific emotions. We took a 24-hour psychophysiological ambulatory monitoring approach to investigate affect regulation during everyday life in 50 patients with BPD and in 50 healthy controls. To provide a typical and unmanipulated sample, we included only patients who were currently in treatment and did not alter their medication schedule. BPD patients reported more negative emotions, fewer positive emotions, and a greater intensity of negative emotions. A subgroup of non-medicated BPD patients manifested higher values of additional heart rate. Additional heart rate is that part of a heart rate increase that does not directly result from metabolic activity, and is used as an indicator of emotional reactivity. Borderline participants were more likely to report the concurrent presence of more than one emotion, and those patients who just started treatment in particular had greater problems in identifying specific emotions. Our findings during naturalistic ambulatory assessment support emotional dysregulation in BPD as defined by the biosocial theory of [Linehan, M.M., 1993. Cognitive–Behavioral Treatment of Borderline Personality Disorder. The Guildford Press, New York.] and suggest the potential utility for evaluating treatment outcome.

Keywords: Ambulatory monitoring; Heart rate variability; Additional heart rate; Biosocial theory; Emotion; Ecological validity

1. Introduction

Borderline personality disorder (BPD) is characterized by severe deficits in interpersonal, cognitive, and emotional functioning (Lieb et al., 2004). Many experts now believe that the pervasive problems in affect regulation (often termed "emotion dysregulation") represent

* Corresponding author. Tel.: +49 621 17034404; fax: +49 621 17034405.
E-mail address: ulrich.ebner-priemer@zi-mannheim.de (U.W. Ebner-Priemer).

0165-1781/$ - see front matter © 2006 Elsevier Ireland Ltd. All rights reserved.
doi:10.1016/j.psychres.2006.04.014

the central area of dysfunction (Linehan, 1993; Coid, 1993; Corrigan et al., 2000; Skodol et al., 2002; Sanislow et al., 2002). According to the biosocial theory of Linehan (1993), emotion dysregulation in BPD comprises increased sensitivity to emotional stimuli, unusually strong reactions, the occurrence of complex emotions (more than one emotion simultaneously), and problems in identifying emotions. However, data actually demonstrating emotion dysregulation is sparse and inconclusive.

Support for the theory of emotion dysregulation is primarily based on subjective measures of emotion and experimental studies. A few studies that used multiple self-rating (diaries) over time reported a higher level of unpleasant affect in BPD patients, compared to a clinical control group (Stein, 1996) and psychologically healthy controls (Cowdry et al., 1991; Stiglmayr et al., 2001). Using self-rating questionnaires, Koenigsberg et al. (2002) found however no evidence of elevated affect intensity in BPD patients when compared with other personality-disordered individuals. Experimental studies that applied emotion-inducing techniques also supported greater emotional dysregulation in BPD: Levine et al. (1997) elicited a heightened intensity of negative emotions in BPD patients, and Herpertz et al. (1997) provided evidence of elevated baseline emotional activation among patients with self-injuries, as compared to healthy controls.

Studies using psychophysiological indicators of emotion have thus far failed to find a consistent pattern of affective dysregulation in BPD. Herpertz et al. (1999) exposed BPD patients and healthy controls to affect-inducing pictures but did not find any hyperreactivity among patients, either with respect to physiological indicators of emotion (heart rate, electromyogram or skin conductance) or to subjective ratings of emotion. In a similar study using functional MRI, Herpertz and colleagues (2001) found no differences in subjective emotions. However, BPD participants did show elevated blood flow in the amygdala. Likewise, Donegan et al. (2003) revealed greater left amygdala activation to emotional facial expression among patients with BPD, and Ebner-Priemer et al. (2005) revealed significantly higher startle response in BPD; enhanced startle response is caused by increased amygdala activation (e.g. by electrical stimulation), at least in animals (Davis et al., 1999). Unfortunately, neither Donegan et al. (2003) nor Ebner-Priemer et al. (2005) reported subjective emotional ratings.

There are a number of possible explanations for these conflicting results. First, BPD patients without medication, who are often recruited for psychophysiological studies, are extremely rare (Zanarini et al., 2004) and may represent a healthier subgroup of BPD patients than medicated individuals. The same argument may apply to patients with BPD who are assessed after a long treatment program. Secondly, it is possible that the affect-induction methods used were insufficient to evoke affective dysregulation and that more personally relevant stimuli are preferable. Thirdly, most studies have been performed in a laboratory environment, and it is possible that the somewhat artificial conditions of the laboratory (e.g. insufficient time for adaptation, the psychological consequences of being observed and contrived experimental protocols) influenced the measurement of affective dysregulation.

One difficulty encountered in the investigation of physiological indices of emotions in ambulatory studies has been the teasing apart of emotional and physical influences. In order to address this problem, Myrtek (2004) developed an algorithm to partition that part of heart rate (HR) increase that does not directly result from physical or metabolic activity; he has termed this measure "additional heart rate" (aHr). The algorithm is based on two experimental findings: namely, that HR reactivity, elicited by a combination of mental, emotional and physical stressors, closely approximates the additive combination of the HR responses evoked by the individual factors (Myrtek and Spital, 1986; Roth et al., 1990), and that metabolic demand can be estimated with sensitive motion detectors (Myrtek, 2004).

This non-metabolic heart rate increase (aHr) appears to be a valid measure of emotional response and has now been validated in multiple studies including more than 1300 participants. For example, aHr in male students was found to be greater when watching erotic films compared to comedies and this applied not only during rest but also under varied levels of physical exercise, and that these physiological differences corresponded to self-ratings of excitement (Myrtek and Bruegner, 1996). This demonstrates that the algorithm is not only able to detect emotional events under basal conditions but also under conditions of activity. Effects on aHr have also been demonstrated for children watching television at home: both school-age boys (Myrtek et al., 1996b) and preschool boys and girls (Wilhelm et al., 1997) manifested greater aHr during films with action scenes. In the same study, girls showed increased aHr while watching commercials that targeted girls (e.g. Barbie), as compared to gender-neutral commercials (Wilhelm et al., 1997). Additionally, one investigation found that train drivers showed higher aHr during situations associated with heightened risk for accidents (Myrtek et al., 1994). aHr is increased during leisure-time activities compared to periods of monotonous work (Myrtek et al., 1999), and in social interactions as compared to being alone (Myrtek et al., 1995). This is