Available online at www.sciencedirect.com
SCIENCE DIRECT®
Journal of Psychiatric Research 38 (2004) 559–565
JOURNAL OF PSYCHIATRIC RESEARCH
www.elsevier.com/locate/jpsychires

Increased diurnal salivary cortisol in women with borderline personality disorder

Klaus Lieb[a,*], Jost E. Rexhausen[a,b,1], Kai G. Kahl[c], Ulrich Schweiger[c], Alexandra Philipsen[a], Dirk H. Hellhammer[b], Martin Bohus[a,2]

[a] Department of Psychiatry and Psychotherapy, University of Freiburg Medical School, Hauptstr. 5, D-79104 Freiburg, Germany
[b] Department of Psychology, Fachbereich I, University of Trier, Universitätsring 15, Building D, 54286 Trier, Germany
[c] Department of Psychiatry and Psychotherapy, University of Lübeck, Ratzeburger Allee 160, 23538 Lübeck, Germany

Received 5 January 2004; received in revised form 25 March 2004; accepted 7 April 2004

Abstract

Borderline personality disorder (BPD) is characterized by a pervasive pattern of instability in affect regulation, impulse control, interpersonal relationships, and self-image. In previous studies, we have used portable mini-computers to assess the severity of recurrent states of aversive emotional distress and dissociation during ambulatory conditions. Here, we used this approach for the assessment of the hypothalamic–pituitary–adrenal (HPA) axis in patients with BPD. We studied 23 unmedicated female patients with BPD and 24 matched healthy controls. Salivary cortisol was collected from all participants during ambulatory conditions in response to reminders provided by portable mini-computers on 3 consecutive days every 2 h for 14 h after awakening. In addition, cortisol in response to awakening was determined in four 15 min intervals on days 1 and 2. After the last collection of cortisol on the second day, 0.5 mg dexamethasone was administered in order to achieve cortisol suppression on day 3 (low-dose dexamethasone suppression test, DST). Patients with BPD displayed significantly higher salivary cortisol levels than healthy controls as demonstrated by higher total cortisol in response to awakening and higher total daily cortisol levels. There were significantly more non-suppressors of cortisol in the low-dose DST in the patient group when compared to the control group. The ambulatory assessment of saliva cortisol is a suitable approach to study basic parameters of the HPA-axis in patients with BPD. Increased adrenal activity and lowered feedback sensitivity of the HPA-axis may characterise BPD. Further studies have to reveal reasons of heightened adrenal activity in these patients.

Keywords: Cortisol; Saliva; Dexamethasone suppression test; Borderline personality disorder; Post-traumatic stress disorder; Depression; Childhood trauma

1. Introduction

Borderline personality disorder (BPD) is characterized by a pervasive pattern of instability in affect regulation, impulse control, interpersonal relationships, and self-image. Clinical hallmarks of the disorder are emotional dysregulation, impulsive aggression, repeated self-injurious behavior and chronic suicidality. In previous investigations, we have carefully assessed key symptoms of the disorder which are most disabling for the patients such as recurrent states of severe and aversive emotional distress (tension) and dissociative experiences and were especially interested in the investigation of diurnal fluctuations of these symptoms. We assessed these fluctuations by the help of portable mini-computers which were given to the patients for three consecutive days and reminded them several times during the day to judge their current degree of aversive tension or dissociation on a Lickert scale between 0 (“no tension/dissociation at all”) and 9 (“most severe tension/dissociation”). Our

* Corresponding author. Tel.: +49-761-270-6681; fax: +49-761-270-6667.
E-mail address: klaus_lieb@psyallg.ukl.uni-freiburg.de (K. Lieb).
[1] J.E.R. died during a car accident in 2003. The results published are part of his doctoral thesis. The manuscript is dedicated to him.
[2] Present address: Central Institute of Mental Health, Mannheim, University of Heidelberg, J 5, 68159 Mannheim, Germany.

0022-3956/$ - see front matter © 2004 Elsevier Ltd. All rights reserved.
doi:10.1016/j.jpsychires.2004.04.002

investigations not only demonstrated that female patients with BPD show significantly higher baseline levels of tension and dissociation, but also suffer from recurrent severe and aversive states of tension and dissociation and that tension and dissociative experiences are highly correlated (Stiglmayr et al., 2001).

In the present study, we used this "naturalistic" approach for the first time to assess neurobiological measures in patients with BPD during ambulatory conditions. As a well-established neurobiological marker which has been extensively investigated in the context of emotional stress and psychiatric disorders, we assessed cortisol levels and used the dexamethasone suppression test (DST) to assess feedback sensitivity of the hypothalamic–pituitary–adrenal (HPA) axis (for review, see Holsboer, 2001). The present study had the following aims: (1) to investigate whether this ambulatory assessment is a suitable and reliable study tool to assess HPA-axis functioning in patients with BPD and (2) to assess HPA-axis functioning in patients with BPD as compared to healthy controls.

In addition to the application of a completely new method to gather neurobiological data in BPD patients, we tried to overcome some of the problems of previous studies which investigated HPA-axis funtioning in patients with BPD (Baxter et al., 1984; Carroll et al., 1981; Kontaxakis et al., 1998; Krishnan et al., 1984; Soloff et al., 1982; Steiner et al., 1984; Sternbach et al., 1983; for review, see De la Fuente and Mendlewicz, 1996; Koenigsberg et al., 1999; Lahmeyer et al., 1989): (1) we excluded patients with a current major depressive disorder (MDD); (2) we controlled potential confounding variables, which may influence HPA-axis functioning such as smoking, menstrual cycle and physical activity; (3) we measured cortisol in saliva, thus preventing artefacts by stress-induced increases in HPA-axis activity due to invasive blood collection; (4) we carefully synchronised all sampling with the individual pattern of awakening of every participant; and (5), most importantly, we assessed HPA-axis functioning not only by determining cortisol levels at a single time point, but in a detailed analysis of cortisol levels on three consecutive days (for overview, see Kirschbaum and Hellhammer, 1994; Kirschbaum and Hellhammer, 1998).

2. Subjects and methods

2.1. Subjects

The study was conducted at the Department of Psychiatry and Psychotherapy of the University of Freiburg Medical School and at the Department of Psychiatry and Psychotherapy, University of Luebeck Medical School (four patients). We included 23 caucasian female patients aged between 19 and 47 years and 24 female healthy controls. All patients met the DSM-IV criteria for BPD, assessed by the appropriate segment of the Structured Clinical Interview for DSM-IV Personality Disorders (SCID-II) (First et al., 1996) and the Diagnostic Interview for Borderline Personality Disorder – Revised Version (DIB-R) (Zanarini et al., 1989). Cutoff scores were 5 or more out of 9 for the DSM-IV-criteria and 8 or more out of 10 for the DIB-R. Exclusion criteria were current comorbid MDD, current substance abuse, mental retardation or schizoaffective disorder as well as a life time history of schizophrenia or bipolar I disorder.

Control subjects (healthy controls, HCs) were healthy women who did not fulfil criteria for BPD (SCID-II), were free of any former or present psychiatric disorder and had never sought psychiatric or psychotherapeutic help. Controls were students, clinic staff (from another department) or acquaintances of the experimenters. The HC were pooled and selectively included only if they were found similar to a patient according to the following requirements: smoking, age, and years of education. As shown in Table 1, there were no significant differences between the groups in any of these variables. However, patients with BPD were less frequently married and more often lived alone than the healthy controls, reflecting diminished stability of social relationships as typical of BPD.

All participants were free of any medication at least for two months prior to the study and did not use oral contraceptives. Patients and healthy subjects gave written informed consent and received reimbursement for their efforts (€100 plus travelling fees). The study was carried out in accordance with the latest version of the Declaration of Helsinki and was approved by the local ethical board of the University of Freiburg Medical School.

2.2. Procedure

To control for a possible modulation of cortisol by changes of estrogen or other hormones during the menstrual cycle, only subjects with regular menstrual cycles were included and all women, patients and con-

Table 1
Sample characteristics[a]

Characteristic	BPD ($n = 23$)	HC ($n = 24$)	Statistics[b]
Age	28.5 ± 1.6	28.2 ± 1.4	n.s.
Gender (f/m)	23/0	24/0	n.s.
Smoker	17 (74)	18 (75)	n.s.
Weight (kg)	63.6 ± 3.0	65.8 ± 2.6	n.s.
Current partnership	7 (30)	14 (58)	$p < 0.05$
Own children	5 (22)	5 (21)	n.s.

[a] Data are given as means ± SD or number (percentage). BPD, borderline personality disorder; HC, healthy controls.
[b] Mann–Whitney U test or χ^2 test.