



Anatomical MRI study of borderline personality disorder patients

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Abstract

Hippocampal volume reduction has been reported in patients with borderline personality disorder (BPD), and is hypothesized to be associated with traumatic childhood experiences. We extended this investigation to explore additional brain regions and other potential clinical correlates of structural brain changes in BPD. Ten unmedicated BPD subjects and 20 healthy controls were assessed for current and past Axis I and II comorbidities and histories of childhood abuse. All had magnetic resonance imaging (MRI) studies with a 1.5 T GE Signa Imaging System, performing three-dimensional-gradient echo imaging (SPGR) with the following parameters: TR=25 ms, TE=5 ms, and slice-thickness=1.5 mm. Compared with healthy controls, BPD subjects had significantly smaller right and left hippocampal volumes, most marked in subjects with childhood abuse, and significantly increased right and left putamen volumes, especially in subjects with substance use disorders. No significant differences between groups were found for caudate, amygdala, temporal lobes, dorsolateral prefrontal cortex and total brain volumes. This study replicated prior findings of diminished hippocampal volumes in subjects with BPD. Also, increased putamen volumes were found in BPD, a finding that has not been previously reported. Early traumatic experiences may play a role in hippocampal atrophy, whereas substance use disorders may contribute to putamen enlargement.

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1. Introduction

Borderline personality disorder (BPD) is a serious mental disorder characterized by affective dysregulation, abnormalities in impulse control, cognitive-perceptual symptoms and unstable interpersonal relationships (Soloff et al., 1994, 2000a; Siever et al., 2002; Skodol et al., 2002a,b). The regulation of mood and impulse, recognition of social signals, control and correction of reward-related and punishment-related behavior, decision making and other higher 'executive functions' depend, in part, upon the functional integrity of neural circuits involving the prefrontal cortex and related structures (Rolls, 2000; O'Doherty et al., 2001). The psychopathology of BPD, especially dysregulation of affect, impulse and cognition, suggests that structural brain abnormalities (especially in prefrontal cortex) could contribute to loss of functional connectivity in the neural circuits modulating these functions. Recent studies using magnetic resonance imaging (MRI) have demonstrated volume abnormalities in brain structures related to regulation of emotion and behavior in BPD.

Lyoo et al. (1998) reported significantly diminished total frontal lobe volumes in subjects with BPD compared with normal controls. BPD subjects were criteria-defined and free of any current or lifetime comorbid Axis I or II disorders. There were no differences between groups for temporal lobes or lateral ventricles. Unfortunately, Lyoo et al. did not separate gray and white matter or control for total brain size. Specific frontal sub-regions were not measured.

Decreased volumes of the hippocampus (Driessen et al., 2000; Rusch et al., 2003; Schmahl et al., 2003; Tebartz van Elst et al., 2003) and the amygdala (Schmahl et al., 2003; Tebartz van Elst et al., 2003) have been reported in BPD patients with early traumatic experiences. A history of childhood traumatic experience is highly prevalent in BPD, with sexual abuse reported by 40–70% and physical abuse by 25–73% of adults with BPD (Zanarini et al., 2000a; Soloff et al., 2002). Reduced hippocampal volume and abnormalities of hypothalamic-pituitary axis (HPA) function are associated with histories of early maltreatment in adolescent females, independent of a diagnosis of BPD (Stein et al.,

1997; DeBellis et al., 1999; Vythilingam et al., 2002), and in patients with posttraumatic stress disorder (Bremner et al., 1995; Gurvits et al., 1996; Bremner et al., 1997; Gilbertson et al., 2002). Stress is related to hyper-glucocorticoid levels (Sala et al., *in press*), which have been associated with decreased hippocampal volume in animal studies (Sapolsky et al., 1990; Kaufman et al., 2000).

We conducted a preliminary study to examine the hypothesis of hippocampal and amygdala volume reduction in BPD associated with histories of childhood abuse, and to investigate the potential involvement of other sub-regions important in the regulation of emotion and impulsive behavior, including the dorsolateral prefrontal cortex (DLPFC), temporal lobes and basal ganglia (De La Fuente et al., 1997; Soloff et al., 2000b; Laakso et al., 2002; Soderstrom et al., 2002).

2. Methods

2.1. Subjects

Ten BPD outpatients diagnosed by the Diagnostic Interview for Borderline Patients (DIB, score ≥ 7) (Gunderson et al., 1981) and meeting the DSM III-R criteria for BPD were studied. Axis II and Axis I disorders were determined, respectively, by the International Personality Disorders Examination (IPDE; Loranger et al., 1987) and the Structured Clinical Interview for DSM III-R (SCID; Spitzer et al., 1988). Childhood abuse was assessed by the means of a 19-item abuse history questionnaire (Soloff et al., 2002). The 24-item Hamilton Depression Rating Scale (HRDS; Hamilton, 1960) was used to rate current depressive symptoms and was administered within a week prior to the MRI study. All patients were medication free for at least 2 months before their participation in the study. In Table 1, details on demographical and clinical variables are reported.

Twenty control subjects were recruited. They were physically healthy individuals with no past or current history of any DSM-IV Axis I or Axis II disorders, no current medical problems, no history of substance/alcohol abuse, and no history of psychiatric disorders among first-degree relatives.

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