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Childhood trauma and basal cortisol in people with personality disorders

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Abstract

This study examined the influence of various forms of childhood abuse on basal cortisol levels in a sample of adults with Axis II personality disorders. Participants included 63 adults (n=19 women) who provided basal plasma cortisol samples and completed the Childhood Trauma Questionnaire. Linear regression analyses that included all five subscales (i.e., sexual abuse, physical abuse, emotional abuse, physical neglect and emotional neglect) demonstrated that Physical abuse was related to lower cortisol levels ($\beta = -.43$, $p=.007$), consistent with prior literature. In contrast, Physical neglect was associated with higher cortisol ($\beta = .36$, $p=.02$), after controlling for other forms of abuse. Results are consistent with the view that childhood trauma has long-lasting neurobiological effects and suggest that different forms of trauma may have distinct biological effects.

Keywords

personality disorder; cortisol; childhood trauma exposure

Introduction

A substantial number of adults with personality disorders report experiences of early trauma (e.g., Bierer et al., 2003; Golier et al., 2003; Zanarini et al., 1997) and recent studies have demonstrated a link between early adversity and low cortisol levels measured in adulthood (Brewer-Smyth, Burgess & Shults, 2004; Weissbecker, Floyd, Dedert, Salmon & Sephton, 2006). The assessment of biological correlates of early adversity is often complicated by the fact that such experiences are not monolithic because both ‘dosage’ (i.e., trauma severity) and type of exposure may have distinct influences on psychopathology and/or have different biological correlates depending on the context in which they are experienced (e.g., Cichetti & Rogosh, 2001; Spertus, Yehuda, Wong, Halligan, & Seremetis, 2003). Thus, although childhood sexual or physical abuse are unquestionably injurious experiences, their long-term impact can be influenced by the extent of concurrent physical and or emotional neglect or emotional abuse.

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Personality disorders are often comorbid with lifetime major depressive disorder (MDD) and/or posttraumatic stress disorder (PTSD) (e.g., Southwick, Yehuda, & Giller, 1993), disorders that are also linked to early trauma exposure (Heim, Plotsky & Nemeroff, 2004; Ozer, Best, Lipsey & Weiss, 2003, Widom, DuMont, Czaja, 2007). MDD is associated frequently with high cortisol levels, supporting the widely held view that chronic stress exposure is associated with increases in hypothalamic-pituitary-adrenal (HPA) axis activity. In the last decade, however, research reports have challenged this view, showing that traumatic stress exposure is associated with lower HPA axis activity, including lower cortisol (e.g., Yehuda, Kahana, Binder-Brynes, Southwick, Mason, & Giller, 1995; Yehuda, Teicher, Trestman, Levengood, & Siever, 1996), particularly among people with a diagnosis of PTSD (for reviews, see Heim & Nemeroff, 2001; Yehuda, 2002). Taken together, these data suggest that the relationship between childhood trauma exposure and cortisol measured in adulthood may vary as a result of the presence of PTSD or major depression. However, if a biological correlate of early adversity reflects an enduring characteristic rather than a state-related manifestation of current illness, the association should be present after accounting for the presence of a current diagnosis. To better understand biological correlates of early adversity in personality disordered adults, we examined the association between plasma cortisol and physical, emotional, and sexual abuse and physical and emotional neglect.

Method

Sixty-three participants, including 44 men and 19 women, were selected from among a larger group of people who participated in a parent study between 1985 and 1997 (e.g., neuroendocrine challenge protocol, see Coccaro et al., 1989). Participants were recruited for the parent study from the outpatient psychiatry service at the Bronx VAMC and clinical referrals, although most were recruited from the community via advertisements. Participants were selected for the current analyses if they met DSM-III-R diagnostic criteria for any personality disorder and they completed the Childhood Trauma Questionnaire (CTQ) (Berstein & Fink, 1998; Bernstein et al 1994).

Participants were excluded from participation in the parent study if there was evidence of systemic medical illness, abnormalities in neurological exam, significant head trauma (with loss of consciousness), current use of psychotropic medications, lifetime history of a psychotic disorder or bipolar I, a diagnosis of substance abuse or dependence in the six months prior to enrollment, or a positive toxicology screen. Written, informed consent was obtained and the IRB committees at Mount Sinai School of Medicine and the Bronx VAMC approved the protocol.

Evaluation

All subjects were interviewed for the presence of Axis I and Axis II psychopathology using the Schedule for Affective Disorders and Schizophrenia (Endicott & Spitzer, 1976) and the Structured Interview for Personality Disorders for the DSM-III-R (Pfohl, Blum & Zimmerman, 1989). During the course of the parent study, a standardized assessment of PTSD was added to the protocol (e.g., the PTSD module of the Structured Clinical Interview for DSM-III-R; First, Spitzer, Gibbon, & Williams, 1996) but was only available for a subset of the sample (n=43). Participants completed the CTQ at a separate session, together with a battery of other self-report measures. The Childhood Trauma Questionnaire is a 28 item questionnaire that measures traumatic childhood experiences across five domains: physical neglect, emotional neglect, physical abuse, sexual abuse, and, emotional abuse. The Hamilton Depression Rating Scale (HDRS) was administered the day of the assessment of cortisol.

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Cortisol

Two baseline plasma samples were collected prior to the initiation of the neuroendocrine challenge protocol. Women were excluded from this protocol if they were taking hormonal contraceptives but were not studied with regard to menstrual cycle. Subjects were instructed to follow a low monoamine diet for the three days prior to the challenge and reported to the General Clinical Research Center at Mount Sinai Medical Center by 7:00 a.m following an overnight fast. At approximately 7:30 AM an I.V. catheter was inserted into the antecubital area. Two baseline blood samples were drawn at 9:45 and 9:55. Blood was drawn into heparinized tubes, spun, and frozen (−20° C) within one hour for subsequent determination of plasma cortisol. Plasma concentrations of cortisol were determined by radioimmunoassay with a prepared kit (ICN/Micromedic, Carson CA). The intra-and interassay coefficients of variation are 6% and 10%, respectively. The neuroendocrine challenge protocol was standardized with repsect to time of day, diet and laboratory procedures for blood sampling, which afforded the opportunity to evaluate the association between plasma cortisol and childhood trauma exposure with minimal influence of these potentially confounding factors.

Statistical analyses

We evaluated sex differences in age, cortisol, the HDRS and CTQ subscales using t-tests for normally distributed variables and Mann Whitney tests for skewed variables (e.g., CTQ subscales). Next, to examine the influence of childhood trauma exposure on basal cortisol after accounting for current diagnoses of PTSD or major depressive disorder, we conducted regression analyses entering a variable denoting the presence versus absence of a current diagnosis of MDD (n=20) or lifetime diagnosis of PTSD (n=5) in the first step, followed by the CTQ subscale scores in the second step of the equation.

Results

Men and women did not differ by age [M(SD) = 39.9(9.7) versus 35.6(8.9) years for men and women, respectively] or baseline cortisol [M(SD) = 11.6 (4.3) μg/dl versus 10.4(3.9) μg/dl for men and women, respectively] as evidenced by nonsignificant t-tests (p's > .26). However, women were more likely to report emotional abuse (X's = 43.9 versus 26.9) and had higher HDRS scores (X's = 17.1 versus 12.4). The average subscale scores of the CTQ in this sample were comparable (or higher) to a comparison group of (mixed) psychiatric inpatients according to published values in the CTQ manual. These averages correspond to scores in the low to moderate range for women on two of the five subscales, and in the moderate to severe range for emotional abuse, sexual abuse and emotional neglect. For men, the scores were in the low to moderate range for all of the subscales (Bernstein & Fink, 1998).

Women were more likely to have a current MDD diagnosis ($X^2(1)=5.5$, p=.02) and men were more likely to be assigned a diagnosis of Schizotypal Personality Disorder ($X^2(1) = 7.1$, p = .008), but there were no other sex differences by diagnostic category. The most commonly assigned Axis II diagnoses included Borderline Personality Disorder (30%), Avoidant Personality Disorder (32%), Paranoid Personality Disorder (29%) and Obsessive-Compulsive Personality Disorder (32%). Table 1 presents nonparametric intercorrelations among the five subscale scores of the CTQ and basal plasma cortisol.

The total CTQ score, representing the sum of the subscales was unrelated to cortisol (r = −.06, p = .63), but results from the regression analyses that considered the subscales separately indicated that the five indices of childhood trauma accounted for 17% of the variation in baseline cortisol levels after controlling for the presence of a current major depressive episode. Of the five predictors, Physical Abuse (β = −.43, p = .007) was associated with lower baseline cortisol, but Physical Neglect was associated with higher cortisol (β = .36, p = .02). The other

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three indices of childhood trauma were not associated with cortisol (p's > .46). It might be noted that post hoc analyses that included additional potential confounding influences (e.g., HDRS scores, gender, age) did not alter the results although we note that we may not have had sufficient power to test the association of these additional variables. Analyses were repeated to determine if a PTSD diagnosis accounted for the association between childhood trauma exposure and cortisol in the subset of individuals who were administered the PTSD module of the SCID-IV (n=43). In these analyses, PTSD was unrelated to cortisol levels (β = .07); physical neglect continued to be negatively associated with cortisol (β = −.61) and physical neglect was positively associated with cortisol (β = .36). In sum, the results were similar, although we note the fact that power to detect an association between PTSD diagnosis and cortisol may have been low.

Discussion

The results from the current study add to our growing knowledge of the relationship between early adversity and cortisol in adults. Results indicated that in a sample of people with personality disorders there was a significant association between physical abuse and low cortisol levels. It should be noted that these results do not provide information about the association between cortisol and personality disorder, per se. Rather, we examined the association in this sample due to the high expected prevalence of adverse childhood experiences among people who develop personality disorders. Examination of normative values of the CTQ indicates that this sample does indeed include a significant number of people reporting moderate to severe levels of childhood trauma (Bernstein & Fink, 1998) and average scores on this measure are comparable to a normative sample of adult psychiatric inpatients. The finding that physical abuse is associated with low cortisol levels is consistent with other reports in the literature (Brewer-Smyth, Burgess & Shults, 2004; Weissbecker, Floyd, Dedert, Salmon & Sephton, 2006), and constitutes an extension in demonstrating that this association is not accounted for by people with a current diagnosis of PTSD, as the physical abuse itself places individuals at risk for the development of PTSD. Physical abuse in childhood is also a risk factor for depression in adulthood and we note that correlation between cortisol levels and physical abuse was maintained when depressive symptoms was included in the model. In contrast, physical neglect, which may lead also to the development of depressive symptoms was *positively* associated with cortisol levels in first order association and was strengthened after controlling for physical abuse.

Interestingly, cortisol levels were not associated with the sum of the five scales, and in fact, correlational analyses confirmed that although there is substantial overlap in the experiences of physical, emotional and sexual abuse and physical and emotional neglect, these scales represent distinct experiences that are not additive. The distinctness of these dimensions was further demonstrated by the fact that cortisol levels were associated with physical neglect in the opposite direction as was observed for physical abuse. The lack of an expected relationship between cortisol and sexual abuse may reflect the fact that most participants were not actively seeking treatment in that they responded to media advertisements soliciting participating in a neurobiological study about personality, suggesting that the level of personality disorder symptomatology was not severe. With respect to retrospective reports of abuse, validity studies indicate that specific details about abuse episodes may be lost or distorted, but people generally recall whether any abuse occurred or not (Berstein & Fink, 1998). Nevertheless, we acknowledge that retrospective reports of abuse can be biased. For these reasons, the results may not informative about the prevalence of traumatic antecedents in personality disorders per se.

Relatively little attention has been given to the possibility that different types of adverse experiences in childhood may be associated with directionally different biologic responses.

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Rather, there has been an emphasis on the timing of trauma from a development perspective (e.g., age of exposure), and dose (e.g., single vs. multiple or chronic exposure). The current results suggest that some of the heterogeneity with respect to biological correlates of adversity may be explained by the nature of the experience. Although speculative, these results suggest that one's behavioral or emotional responses to different types of trauma may influence physiological responsivity in opposing ways. For example, physical abuse may engender feelings of helplessness and disengagement, while neglect might activate an individual to seek care elsewhere (i.e., from another family member, neighbor or teacher). It must also be noted that a further complexity is that physical abuse and neglect are themselves positively related. That is, a substantial number of people who are physically abused are also physically neglected. Additional research in larger samples is needed to both replicate the current findings and disentangle the association of physical abuse versus neglect to plasma cortisol levels. Longitudinal research, for example, could establish the temporal sequence between physical abuse and neglect and its influence on cortisol measured over multiple time points.

Although the functional significance of either low or high cortisol levels as measured on a single time point is not established, that cortisol levels are related, in a personality-disordered sample, to self-rated experiences thought to be formative indicators of psychopathology may be noteworthy in underscoring a contribution of environmental experiences to the biology of personality disorders. It is alternatively possible that cortisol levels relate to risk for specific environmental exposures or the retrospective recall and/or subjective interpretation that these experiences occurred in childhood. The current findings add to our knowledge in their demonstration that the associations between cortisol levels and early experiences are not explained by the presence of state-related alterations in cortisol associated with the presence of a major depressive episode or PTSD. Whether and to what extent biological alterations resulting from early experiences constitute risk factors for psychopathology remains to be determined by future longitudinal studies. The current findings suggest that such studies consider the contributions of and interactions among a wide range of potentially adverse experiences.

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Table 1

Intercorrelations (Spearman's rho) among the five CTQ subscales and cortisol

	2	3	4	5	6
1. Physical Abuse	**.50**	**.47**	**.45**	.19	**−.26**
2. Sexual Abuse	--	**.45**	**.38**	.07	−.07
3. Emotional Abuse		--	**.40**	**.55**	.00
4. Physical Neglect			--	**.34**	.23*
5. Emotional Neglect				--	.04
6. Cortisol					--

Note: Bold coefficients are $p < .05$,

* p=.069