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Long term effects of childhood trauma on cortisol stress reactivity in adulthood and relationship to the occurrence of depression

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Summary
Background and aims: Childhood trauma may have longstanding effects on individuals' propensity to react adversely to stress, and also predisposes individuals to suffer from depression. The current study aimed to examine stress reactivity in individuals with and without a history of childhood trauma by measuring cortisol responses to the passive viewing of stressful images, specifically including images relevant to childhood trauma. In addition, participants with and without a diagnosis of current depression were studied to investigate whether cortisol stress reactivity may underlie resilience or vulnerability to depression.
Methods: The study involved 17 healthy participants with and 24 without a history of childhood trauma; and 21 depressed patients with and 18 without a history of childhood trauma. Salivary cortisol was measured before, during and after participants were shown affectively laden images, including standardised scenes from the International Affective Picture System and also images suggestive of childhood abuse. Cortisol stress reactivity to the passive image viewing was compared between groups.
Results: In those who had experienced childhood trauma, cortisol stress responses were overall low and the same in those who were depressed and those who were not (mean stress reactivity variable — depressed: 0.8 nmol/l; non-depressed: 0.72 nmol/l). In contrast, cortisol stress

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reactivity was raised in depressed subjects relative to those who were not depressed in those without a history of childhood trauma (mean stress reactivity variable — depressed: 3.75 nmol/l; non-depressed: 0.1 nmol/l).
Conclusions: A history of childhood trauma has longstanding effects on adulthood cortisol responses to stress, particularly in that depressed individuals with a history of childhood trauma show blunted cortisol responses. However, there were no differences between abused depressed and abused non-depressed subjects on cortisol stress responses, suggesting that such a finding does not explain subsequent susceptibility to depression. On the other hand, patients who experience depression without a history of childhood trauma show enhanced cortisol stress reactivity, which could help explain the aetiology of their depressive illnesses. Differences between the current findings and those using other pharmacological and stress challenge paradigms may relate to the type of stimuli used and to dysfunction at different levels of the hypothalamic—pituitary—adrenal (HPA) axis.

1. Introduction

In the face of an aversive event, psychological stress generates a cascade of physiological and behavioural responses enabling an organism to adapt to the situation in order to protect itself. Immediately after a threatening event is perceived, the hypothalamic—pituitary—adrenal (HPA) axis is activated causing an increase in the circulating level of its end product, corticosteroids, which interact with cognitive functions as well as bodily functions of immunity and inflammation (de Kloet et al., 1999; McEwen, 1998).

The homeostasis of the HPA axis can be dysregulated by excessive release of corticosteroids in response to chronic or severe stress (de Kloet et al., 2005). Children's brains, in which development is still ongoing, are particularly vulnerable to such overexposure to corticosteroid. The adverse effect of this HPA axis dysregulation may contribute to the high prevalence of depression within abused populations in epidemiological studies (Chapman et al., 2004). Previous neuroendocrinological studies have investigated this relationship by attempting to identify hormonal abnormalities specific to individuals with a history of childhood trauma that may play a mediatory role between early life stress and depression. The Trier Social Stress Test (TSST: Kirschbaum et al., 1993), a psychosocial stress challenge in which individuals are asked to make a speech and/or to perform arithmetic tests in public, has been used to examine hormonal abnormalities in cortisol stress reactivity. The TSST aims to create a naturalistic situation imposing psychological stress in a standardised manner, and has previously been used in many studies that examine individual differences in cortisol stress reactivity.

Previous studies of the TSST on samples with a history of childhood trauma have shown lower cortisol reactivity in healthy adults (Carpenter et al., 2007), both men (Elzinga et al., 2008) and women (Carpenter et al., 2010), but have shown increased responses in depressed women (Heim et al., 2000a,b). With a history of childhood trauma, depressed adolescents have also shown increased responses (Rao et al., 2008), but only when the symptoms are mild (Harkness et al., 2010). In contrast, healthy female adolescents (MacMillan et al., 2009) and healthy children (Ouellet-Morin et al., 2011) show lower responses.

Taking these findings together, cortisol responses may be lower in those who remain well in adulthood despite their experience of early life stress, but higher in those who later develop depression. Thus, it may be that there are differential effects of childhood trauma on cortisol stress reactivity. Childhood trauma may confer on some individuals neuroendocrine resilience in the form of blunted cortisol reactivity protecting against subsequent adulthood stress, and this may prevent them from manifesting depression. Childhood trauma may, however, confer on others neuroendocrine vulnerability in the form of enhanced cortisol reactivity to adulthood stress, which may make those individuals more likely to manifest depressive symptoms.

The TSST, however, may not be uniformly effective with all individuals because responses can vary depending on individuals' personality traits. Psychosocial stress may particularly be amplified in socially anxious or young individuals, but may not have the same effect on individuals who have little fear in performing tasks in public, particularly when the task does not directly involve social evaluations such as in exams or job interviews (Dickerson and Kemeny, 2004; Wiemers et al., 2013). Therefore, results from using this paradigm may not generalise to different sample types.

In order to address this limitation, the current study used a passive image viewing paradigm, aiming to produce a condition that is more generally accepted as stressful in any healthy population. Participants are shown stress-inducing images that are suggestive of scenes of childhood trauma, and negative images chosen from the International Affective Picture System (IAPS: Lang et al., 2005) based on published affective norms. The IAPS is frequently used as material for experimental psychophysiological paradigms measuring the magnitude of eye blinks in response to startle, and its modulation by affective valence of images (Lang et al., 1990). It has successfully been demonstrated that individuals show differential emotional physiological responses to negative versus positive affective valence of images. Thus, negative images enhance the startle response that forms part of the human fight or flight reaction (Lang et al., 1990), whilst repetitive presentation of such negative images can elicit consequent changes in neuronal and endocrine stress mechanisms. This evidence is robust in healthy individuals, suggesting that the level of stress induced by negative