

Changes in regional cerebral blood flow after body image exposure in eating disorders

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Abstract

Relationships of ‘perceptual distortion’ and ‘cognitive evaluation’ components of body image disturbances to brain activity were investigated. Changes in regional cerebral blood (rCBF) of nine patients with anorexia nervosa restrictive type (AN), 13 patients with bulimia nervosa purging type (BN) and 12 controls following three experiments with single photon emission computed tomography (SPECT) were compared: at rest, following a landscape video presentation (neutral stimulus), and after their filmed body image (positive stimulus) exposure. Body distortion was measured with the Silhouette test and body dissatisfaction with the Body Shape Questionnaire (BSQ). Patients with AN showed a hyperactivation of the left parietal and right superior frontal from neutral to positive stimulus. Patients with BN showed a hyperactivation of the right temporal and right occipital areas. Changes in BSQ responses were associated with changes in the right inferior frontal and right temporal rCBF, whereas changes in body distortion were related to the left parietal. The activation of the right temporal after the own body image exposure might be in accordance with the aversive events’ response. Functional abnormalities in AN might be related to the storage of a distorted prototypical image of the body in the left parietal lobe.

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1. Introduction

A body image disturbance is considered to be a key characteristic of patients suffering from an eating

disorder (ED) such as anorexia nervosa (AN) and bulimia nervosa (BN). It is, however, a complex phenomenon whose inherent multidimensionality (neuro-physiological, cognitive and emotional aspects) is a serious challenge for researchers. Two independent components of body image disturbance have been distinguished: a distorted body perception (‘body distortion’) and a negative cognitive evaluation (‘body

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dissatisfaction') (Gardner and Garfinkel, 1981; Gardner, 1996; Cash and Deagle, 1997). With respect to neuropsychology, several studies have tried to address questions as to whether there is a localized body image neural module, whether it corresponds to the somatosensory areas of the brain, and whether it is separate from the cerebral locations of our assembled knowledge and beliefs about our bodies (Pruzinsky and Cash, 2002). Body awareness is a complex and dynamic process including sensory modalities, affective experiences and cognitive interpretations. Still, it is not clear how the brain integrates the relevant information to compute something we call 'body image'. Despite several limitations due to methodological difficulties, neuroimaging studies – mainly functional techniques – are improving the understanding of ED, particularly with respect to the brain areas that might be implicated (Chowdhury and Lask, 2001; Frank et al., 2004). Besides the hypoperfusion (Kuruoglu et al., 1998; Naruo et al., 2000; Takano et al., 2001; Râstam et al., 2001; Chowdhury et al., 2003) and hypometabolism found in AN and BN in resting conditions (Delvenne et al., 1999), task activation experiments have shown areas of brain activation that might be specific to the pathophysiology of ED. Food imagination, visual presentations and eating high caloric food provoke anxiety and increase activation in areas related to emotional restorage such as the amygdala (Nozoe et al., 1995; Naruo et al., 2001; Gordon et al., 2001; Santel et al., 2006), and in areas of executive function, decision-making, error monitoring and reward expectancy, as the anterior cingulate cortex and medial prefrontal (Uher et al., 2004). More research is needed, however, to clarify the nature of those changes. At present, very few studies have investigated the rCBF changes in the recovery process of AN (Kojima et al., 2005; Matsumoto et al., 2006). Furthermore, controversial findings regarding body image dysfunction have been reported. To be explicit, the temporomesial area has been associated with the perception of unpleasant words concerning body image (Shirao et al., 2003). In addition, neuroimaging studies using digital body images have shown right amygdala activation (fear network) in AN patients, comparable to the reactions in patients with an anxiety disorder who are recalling aversive memories (Seeger et al., 2002). Nonetheless, the same group reported a larger series of patients (Wagner et al., 2003) and had somewhat different findings: compared with healthy controls, AN patients experienced a hyperresponsiveness in the inferior parietal lobe, suggestive of a disturbance in the visuospatial processing of the own body shape. Finally, brain

responses to line drawings of underweight, normal and overweight female bodies have been assessed with functional magnetic resonance (Uher et al., 2005). ED patients rated the body shapes as more aversive than healthy women, and this correlated positively with activity in the right medial apical prefrontal cortex.

A number of controversial aspects regarding the nature and impact of body image disturbances may possibly be elucidated in the future, for instance, by means of activation techniques assessing the interaction of cognitive and emotional processing in ED (Chowdhury and Lask, 2001). At the moment, we do not know of any research assessing at the same time the relationships of both the 'perceptual distortion' and the 'cognitive evaluation' components of body image disturbance with brain activity, controlling for the influence of anxiety and depressive symptoms. Considering that BN and AN patients have shown differences regarding body image disturbance, distortion as well as dissatisfaction (Cash and Deagle, 1997), it would be interesting to test whether those differences may be replicated and show a correlation with brain activity. We have designed the present study to answer the following question: Do AN patients differ from BN patients and control participants with regard to the patterns of change in regional cerebral blood flow (rCBF) from baseline to their own body image exposure and from baseline to a neutral stimulus exposure? Beyond the existing imaging literature, this study offers the comparison of the mentioned three groups. The main hypothesis was that patients with AN and BN, compared with healthy people, might reveal different regional patterns of brain activation within the above-described experiments, probably related to the somatosensory and emotion processing systems, respectively. This investigation is part of a longitudinal study also aimed at evaluating therapeutic interventions.

2. Methods

2.1. Participants

Twenty two women diagnosed (according to DSM-IV) with an ED participated in the study: 9 AN patients (restrictive type) and 13 BN patients (purging type). They were consecutively recruited amongst those receiving treatment at the Eating Disorders Unit of Ciudad Real General Hospital (Spain). The 12 normal females (NC) were recruited from the University College of Nursing. Participants were older than 18 years of age, all were right-handed and none of them had a history of neither substance abuse, neither suffered from any comorbid major psychiatric (ruled out with the SCID) (First et al.,

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