Available online at www.sciencedirect.com
ScienceDirect
Clinical Psychology Review 28 (2008) 228–246
CLINICAL PSYCHOLOGY REVIEW

Neuroimaging studies of psychological interventions for mood and anxiety disorders: Empirical and methodological review

Paul A. Frewen [a], David J.A. Dozois [a,b], Ruth A. Lanius [b,c,*]

[a] Department of Psychology, The University of Western Ontario, Canada
[b] Department of Psychiatry, The University of Western Ontario, Canada
[c] Department of Neuroscience, The University of Western Ontario, Canada

Received 31 January 2007; received in revised form 4 May 2007; accepted 14 May 2007

Abstract

This article reviews the methods and results of published neuroimaging studies of the effects of structured psychological interventions for mood and anxiety disorders. The results are consistent with neural models of improved affective- and self-regulation, as evidenced by psychotherapeutic modulation of brain metabolic activity within the dorsolateral, ventrolateral, and medial prefrontal cortices, the anterior cingulate, the posterior cingulate/precuneus, and the insular cortices. Specific recommendations for future studies are outlined, and the clinical and theoretical significance of this research is discussed.

Keywords: Neuroimaging; Positron emission tomography (PET); Functional magnetic resonance imaging (fMRI); Psychotherapy; Cognitive behaviour therapy; Interpersonal psychotherapy; Mood disorder; Anxiety disorder; Depression

Contents

* Corresponding author. London Health Sciences Centre, 339 Windermere Road, PO Box 5339, London, Ontario, Canada N6A 5A5. Tel.: +1 519 663 3306; fax: +1 519 663 3935.
E-mail address: ruth.lanius@lhsc.on.ca (R.A. Lanius).

0272-7358/$ - see front matter © 2007 Elsevier Ltd. All rights reserved.
doi:10.1016/j.cpr.2007.05.002

Cognitive-, affective-, and social-psychology research are increasingly becoming integrated with the neurobiological study of emotion, depression, and anxiety disorders under the banner of the social-cognitive and affective neurosciences (e.g., Davidson, 2000; Davidson et al., 2002; Lieberman, 2007; Murphy, Nimmo-Smith, & Lawrence, 2003; Ochsner & Gross, 2005). Indeed some researchers (e.g., Davidson et al., 2002) contend that the synthesis of psychological with neurobiological approaches to the study of depression and anxiety is of utmost importance to a comprehensive understanding of the etiology and effective treatment of these disorders.

Such interdisciplinary endeavors have been facilitated, in part, by the rapid development and research utilization of non-invasive methods for probing the neural processing underlying psychological functioning in humans, including in individuals with psychiatric disorders. These approaches include the functional neuroimaging technologies of positron emission tomography (PET) and functional magnetic resonance imaging (fMRI) (see Miller, Elbert, Sutton, & Heller, 2007, for review). PET and fMRI assessments measure tonic and/or discrete event-related metabolic activity as varying within distinct regions of the brain across time, such as indexed by glucose metabolic rate (PET) or blood oxygenation of vessels within surrounding neural tissue (fMRI); such metabolic activity is understood to indirectly assess neural activity as neural firing regionally impacts glucose and oxygen metabolism. Brain metabolic activity of individuals with and without psychiatric disorders can therefore be compared to identify the functional neural circuitry that may distinguish these groups. Pre-post changes in brain metabolic activity that occur with effective psychiatric treatment can also be examined to study the functional neural correlates of such treatment.

The present article reviews the experimental methodology and empirical results of 11 seminal neuroimaging studies published to date investigating the effects of participation in structured psychological interventions for mood and anxiety disorders on brain functioning. Specifically, the neural effects of cognitive-behavioural therapy (CBT) and interpersonal psychotherapy (IPT) are reviewed. Given that CBT and IPT are empirically-supported treatments for mood and anxiety disorders (Butler, Chapman, Forman, & Beck, 2006; Chambless & Ollendick, 2001; DeRubeis & Crits-Christoph, 1998; National Institute for Clinical Excellence, 2004), it may not be surprising that they might impact brain functioning in the direction of improved psychological health. These approaches are based on sound theoretical and empirically-tractable models of the psychological mechanisms involved in the etiology, maintenance, and amelioration of these disorders. Cognitive models posit that schemas or mental networks represent individual constellations of beliefs and attitudes about self, others, the environment, and experienced psychological and physiological symptoms. These schemas or mental networks are purported to moderate one's level of vulnerability to cognitive and affective disturbance within the context of stressful life events (Beck & Emery, 1985; Beck, Rush, Shaw, & Emery, 1979; Clark, Beck, & Alford, 1999; Ingram, Miranda, & Segal, 1998; Mathews & MacLeod, 2005). Although a multitude of CBT approaches have been tailored as interventions for specific mood and anxiety disorders, most therapies share the goals of regulating negative affect and arousal, restructuring negative self-referential cognition, improving problem-solving capacities, and increasing positive social-behavioural activity (Dobson & Dozois, 2001). Interpersonal models hypothesize that the way an individual perceives and is perceived by others within social relationships plays an integral role in vulnerability to mood and anxiety disorders (Coyne, 1976; Joiner & Coyne, 1999; Hammen, 1991; Segrin, & Dillard, 1992). Accordingly, interpersonal psychotherapy involves a concerted effort to restructure negative interpersonal relationships and foster positive social interactions as a means of decreasing negative affect and cognition related to depression and anxiety.

Studies conducted to date collectively suggest that CBT and IPT effectively alter brain function in individuals with unipolar mood disorders (Brody et al., 2001; Goldapple et al., 2004; Martin, Martin, Rai, Richardson, & Royall, 2001), obsessive–compulsive disorder (OCD; Baxter et al., 1992; Nakatani et al., 2003; Schwartz, Stoessel, Baxter, Martin, & Phelps, 1996), panic disorder (Praško et al., 2004), social anxiety disorder (Furmark et al., 2002), specific (spider) phobia (Paquette et al., 2003; Straube, Glauer, Dilger, Mentzel, & Miltner, 2006), and posttraumatic stress disorder (PTSD; Felmingham et al., 2007) in a manner that is consistent with the decreased psychiatric symptoms observed with these treatments. The present article reviews this emerging literature in detail to examine: (1) the clinical and theoretical