Differential Activation and Enhancing Interactions in Cortico-striato-thalamic Circuitry with Depression and Insecure Attachment

Authors: Zimri S. Yaseen, MD, Igor I. Galynker, MD, PhD, Curren Katz, MEd, Xian Zhang, PhD, Gillian Jennings-Donovan, BA, Stephen Dashnaw, Joy Hirsch, PhD, Helen Mayberg, MD, Lisa J. Cohen, PhD, Arnold F. Winstone, MD

Abstract

Objective: Insecure attachment has been linked to depression and to outcome in psychotherapy. The neural mechanisms subserving the relationship between attachment security and depression are not well understood. We examine women’s brain activity in response to early and late attachment figure viewing.

Methods: Twenty-eight women, half depressed, viewed images of their mother, a female friend, and female strangers during fMRI scanning. The effects of depression and insecure attachment were determined with whole-brain multiple linear regression of blood-oxygen-level-dependent (BOLD) response against subjects’ Beck Depression Inventory (BDI) and Adult Attachment Interview (AAI) coherence of mind scores. Interaction effects were analyzed with ANOVA.

Results: For early attachment (Mother-Friend contrast), depression scores correlated with activation of cortical and sub-cortical components of cortico-striato-thalamic circuits implicated in the modulation of affect, while attachment insecurity correlated with subcortical activity in the same circuits. Depression and attachment insecurity correlated with both cortical and subcortical activity for Mother-Stranger. For late attachment (Friend-Stranger contrast), only cortical effects were found. Depression and insecure attachment showed mutually enhancing effects in multiple brain areas.

Conclusion: Depression and attachment insecurity may be subserved by similar but distinct components of affect regulating circuits and demonstrate mutually enhancing interactions. This may explain greater treatment resistance for sufferers of depression who are insecurely attached. Differential subcortical versus cortical encoding of early versus late attachment suggests a top-down model of late attachment, potentially relevant to psychotherapeutic outcome. This study was funded by The Hope for Research Foundation Research.

Introduction

Linkage between depression and attachment style is suggested both by correlations of specific attachment styles and of attachment security with psychopathology and brain structure and behavioral risk. Understanding how insecure attachment affects depression could have significant treatment implications.

Methods

Stimuli were color photographs of the subject’s mother (M), a close female friend (F) and female strangers, age matched to mothers and friends. There were 4 (M/R/I/S) scans per subject. Each scan consisted of 3 blocks. For each block, one of three tasks was defined for the subject with a written prompt at the beginning of the block. The prompts were: “How much can you relate to this picture?” (Relational task), “How pleasant do you feel when you look at this picture?” (Valence task) and “Press any button when you see the picture” (Passive task). Each block consisted of 10 trials, with a picture viewed through goggles for 3 seconds. During this time subjects used their right hands to rate pictures according to the prompt by a recorded button press.

The effects of depression and insecure attachment were determined with whole-brain multiple linear regression of blood-oxygen-level-dependent (BOLD) response against subjects’ Beck Depression Inventory (BDI) and Adult Attachment Interview (AAI) coherence of mind scores. Interaction effects were analyzed with ANOVA.

Discussion

1) Depression and insecure attachment activated both overlapping and distinct components of the cortico-striato-thalamic circuits related to affective processing. ChieflYthese areas comprised orbital and medial PFC regions, anterior insula, anterolateral PFC regions, ventral caudate, ventral putamen and medial thalamus.

2) Insecure attachment enhanced the effects of depression on brain activity in response to both pictures of early attachment figure (M-S contrast - relative activation in putamen and inferior orbitofrontal cortex and deactivation in lateral PFC) and late attachment figure (F-S contrast - activation in medial PFC). The presence of altered activity in these emotional reward-related areas is consistent with interpretation of insecure attachment as a failure to respond positively to maternal attention. Indeed, the effects of early attachment disruptions on brain activity consistently implicate the OFc (Hanson et al., 2010). The enhancing interactions in brain activity response to affectively significant stimuli may support a causal element in the association observed between insecure attachment and depression.

3) Activation with pictures of mothers (early attachment) involved both cortical and subcortical components of cortico-striato-thalamic circuits. In contrast, late attachment associated activity was exclusively cortical for depression, attachment security, and their interaction effects. This supports the hypothesis that late attachment may form in a more “top-down” manner. Dysfunction and disruption of relationships with late attachment figures often serve as triggers for depression and as targets for repair in psychotherapeutic interventions. Our findings may thus likewise support a “top-down” theory of psychotherapeutic efficacy in the treatment of depression (DeRubeis et al., 2008).

Conclusions

- Depression and attachment insecurity are subserved by overlapping but distinct components of cortico-striato-thalamic circuits related to affect regulation.
- Linear effects for depression and attachment security support a dimensional approach to these phenomena.
- Enhancing interactions are present between insecure attachment and depression and may suggest an etiological role for insecure attachment in depression, and may account for greater difficulty in treating depressed patients who are insecurely attached.
- Greater subcortical activation for early attachment, with late attachment associated activity being found primarily in cortical portions of cortico-striato-thalamic affective circuitry, may suggest a ‘top-down’ model for adult attachment formation, which may be relevant to understanding how and when psychotherapy is able to effect therapeutic change in attachment.

References