Neural Activity in Anticipation of and in Response to Both Aversive and Neutral Pictures in Generalized Anxiety Disorder

Desmond J. Oathes¹, Issidoros Sarinopoulos¹,2, Ned H. Kalin¹, and Jack B. Nitschke¹

¹University of Wisconsin, Departments of Psychiatry and Psychology and Waisman Laboratory for Brain Imaging and Behavior, Madison, WI
²Michigan State University, Department of Psychology, East Lansing, MI

Introduction

• Patients with generalized anxiety disorder (GAD) worry excessively about the future and show behavioral hypervigilance to threat (1). To better understand this type of anxiety, our previous work focused on neural patterns of aversive anticipation (2).

• Chronic worry and GAD are also associated with emotional avoidance (3) consistent with findings of cardiovascular (4) and pupillary responsivity (5).

• Vigilance-avoidance models of anxiety suggest a possible connection between vigilant anticipation and avoidance of emotionally evocative material (6).

• We hypothesized that the same neural areas previously associated with hyperactivation during anticipation in GAD subjects (amygdala, hippocampus, insula, anterior cingulate) would become relatively hypoactive for that group during actual picture exposures compared to control subjects.

Methods

14 GAD patients (no other Axis I disorders); 12 Controls (no current or past Axis I disorders)

Event-related design modeled after previous study in our lab (2): 0.5-s warning cue then 2.5- or 4.5-s blank screen then 1.0-s displays of aversive or neutral pictures (7) then 13- or 15-s blank screen to allow hemodynamic response to return to baseline (see Figure below).

Results

A significant Group (GAD, Control) x Period (Warning, Picture) interaction was present F(1,24)=33.32, p<.001 in bilateral amygdala (right - 569 voxels; left - 210 voxels), bilateral hippocampus (right - 522 voxels; left - 66 voxels), bilateral fusiform (right - 510 voxels; left - 262 voxels), and bilateral occipital areas (right - 217 voxels, left - 89 voxels). Independent sample t-tests were used for group posthoc comparisons.

Post hoc Tests

• During the warning period, GAD patients showed significantly heightened anticipatory activation in the right amygdala before aversive and neutral pictures compared to control subjects (ps<.05). During picture periods, the group difference reversed due primarily to increased activity for controls which was not present with GAD patients (aversive and neutral; ps<.05).

• GAD patients also showed larger hippocampus responses than controls in anticipation of aversive pictures (ps<.05). The pattern of GAD patients showing smaller neural responses to the pictures than controls was observed in the left amygdala during negative pictures, right hippocampus during negative and neutral pictures, left and right fusiform areas during negative and neutral pictures, and right occipital cortex during negative and neutral pictures (ps<.05).

Conclusions

• Consistent with previous findings (8), GAD patients relative to controls showed anticipatory hyperactivation during warning periods before presentations of emotional pictures in the amygdala and the hippocampus. This period was followed by hypoactivation during picture viewing for the GAD group relative to controls in bilateral amygdala, hippocampus, and areas associated with visual processing.

• Results support a combination of vigilance and avoidance tendencies in GAD patients according to the temporal dynamics of emotional processing. Follow-up treatment data from our lab (9) suggest that observed anticipatory and response processes in the amygdala are normalized with successful treatment in GAD patients.

References


Presented at Society for Neuroscience 2007. For additional information, contact DJO at oathes@wisc.edu.