INTRODUCTION

Anticipation and uncontrollability have been implicated as major contributors to anxiety disorders (Barlow, 2002). Previous research has found that in anticipation of threatening stimuli, various areas of the brain along with the sympathetic nervous system (autonomic responses like skin conductance response (SCR)) are activated abnormally in anxiety disorders. The current research explores the link between the specific brain areas activated in snake phobia (amygdala, insula and anterior cingulate cortex (ACC)) and SCR in the anticipation of, and in response to, aversive stimuli in both Phobic and Nonphobic controls. We hypothesize that SCRs in Phobics will be greatest in anticipation of and response to snake videos and in Nonphobics to disgust, consistent with activation in amygdala, insula and ACC.

METHODS

Participants

Two groups of participants were studied. Snake phobics consisted of 18 participants (n=18, 15 females, mean age 20.1, range 18-26) and Nonphobics consisted of 18 participants (n=18, 15 females, mean age 20.6, range 20-28). Participants were right-handed and neurologically normal. Phobics met criteria for DSM-IV diagnoses of specific phobia of snakes and were absent of all clinical disorders as assessed by the Structured Clinical Interviews for the DSM-IV (First et al., 1996). Nonphobics were absent of all clinical disorders including specific phobia of snakes as assessed by the SCID. Informed consent in accordance with rules set by the University of Wisconsin at Madison Human Studies Committee was obtained from all participants prior to the experiment.

Stimuli

The stimuli consisted of 3-s snake, disgust, and fish videos (24 each). Each video was standardized for several psychological attributes (e.g. arousal, valence, etc.) during pilot rating sessions prior to the study. Additionally, physical attributes such as brightness, contrast, scene complexity and movement of the stimuli were equalized. Videos were presented to participants in the scanner using Aventec goggles mounted on the head coil of a 3 Telsa GE SiGMA Scanner (TR=2 s).

Procedure

Experimental Paradigm:

Each trial began with an anticipation period signaled by a cue. An S preceded snake videos, a D preceded disgust videos, and an F preceded fish videos. Subjects were instructed at the onset of the study that they would be receiving these videos. Uncontrollability was indicated by the color of the anticipation cue. A blue or yellow cue indicated a controllable trial, and the other color indicated an uncontrollable trial. When a subject had an uncontrollable trial, they invariably receive the video. When a subject had a controllable trial, if reaction time (RT) was fast enough to a red target square that followed the cue after a variable delay, they received a fixation cross rather than the anticipated video. Otherwise, they received the anticipated video. Of the 72 total video trials, half were cued as uncontrollable and the other half controllable. A success rate of approximately 50% online monitoring of RT by DMEDX software. Each trial ended with one Likert online rating about the nature of the stimulus-valence, arousal, disgust, and fear-counterbalanced across condition.

RESULTS

Behavioral SCR

T-tests were used to compare skin conductance response amplitudes (Figure 1) between Nonphobics and Phobics during the anticipation and video epochs. Phobics showed larger SCRs in anticipation of snake than fish (t = 3.873, s), and disgust than fish (t = -2.706, s). Nonphobics did not show a significant difference between means during the anticipation epoch. During the video epoch, Phobics showed greater responses during all contrasts: Snake than fish (t = 3.786, s), snake than disgust (t = -2.763, s) and disgust than snake (t = -2.348, s). Nonphobics showed greater SCRs to disgust than fish (t = -3.304, s) during the video epoch.

Imaging Results: Voxel-Wise Anova

A voxel-wise whole brain 2 (group: Phobic/Nonphobic) x 3 (stimulus: S, F, D) was performed for the anticipation period. Resulting activation averages for bilateral insular regions found active to the interaction of group and stimulus type (driven by group difference in S cue and a main effect of group) were regressed onto SCR equivalent contrasts. These regressions revealed the following significant relationship between activation in these particular bilateral insular regions and greater SCR in Nonphobics during anticipation of disgust videos as opposed to fish videos (D-F contrast) during the anticipation period.

Nonphobic SCR Predicts Greater Bilateral Insula Activation During Anticipation of Disgust vs. Fish videos.

SCR Response in Phobics and Nonphobics by Period

Data Analysis

Behavioral SCR analysis procedures (artifact removal, head movement compensation and atlas transformation) are detailed in previous publications (Mackiewicz et al., 2006) and are available in a handout. The data were analyzed using a least-squares general linear model (GLM) fit to the gamma variate hemodynamic response function (GAM) to fit the cue (Epoch 1), video/fixation (Epoch 2), and rating/fixation (Epoch 3) periods upon which voxel wise t-tests were performed. Cluster extraction analyses were then performed on the resultant percentage signal change maps with a threshold of p < .005 with a voxel size of 1mm3 (voxel sizes of each cluster are indicated in Figures).

REFERENCES


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