Neural Correlates of Anticipation and Uncontrollability in Snake Phobia

INTRODUCTION

Anticipation and uncontrollability have been implicated as major contributors to anxiety disorders in general (Barlow, 2002). Consistent with a large literature on brain responses to aversion, a recent study in our laboratory (Nitschke et al., 2006) implicated a number of brain regions in the anticipation of and response to aversive pictures, including the anterior cingulate cortex (ACC), insula, amygdala and orbital frontal cortex (OFC). The present event-related fMRI study enrolled volunteers both with and without specific phobia of snakes to identify the neural areas recruited in the anticipation of and response to videos of differing emotional content (snake, fish, disgust). Uncontrollability was manipulated by giving subjects control on half of the trials to avoid viewing the videos. Barlow's theory of anxiety emphasizes uncontrollability as one of the most important general psychological influences on the development of specific phobias. Research on anxiety has investigated uncontrollability over video presentation will result in larger neural responses than when video presentation can be controlled.

HYPOTHESES

1. In phobics, anticipation of snake videos will activate regions identified in Nitschke et al. (2006), including the insula and amygdala.

2. Uncontrollability over video presentation will result in larger neural effects for the disgust videos but not the snake videos.

METHODS

Participants

Two groups of participants were studied. Snake phobics consisted of 12 participants (9 females, mean age 23, range 18-46) and Non-phobics consisted of 12 participants (4 females, mean age 23, range 19-30). Participants were right-handed and neurologically healthy. Phobics met criteria for DSM-IV diagnosis of specific phobia of snakes and were absent of all other clinical disorders as assessed by the Structured Clinical Interview for the DSM-IV (First et al, 1997). Non-phobics were absence of any clinical disorders including specific phobia 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, fish, and disgust videos (24 each). Each video was standardized for several psychological attributes (e.g., arousal, valence, disgust, fear) during pilot rating sessions prior to the study. Physical attributes such as brightness, contrast, scene complexity and movement of the stimuli were equalized. Videos were presented to participants in the scanner using Axscan graphics mounted on the head coil of a 3.0 Tesla GE MRI Scanner (TR=2 sec).

Procedure

Experimental Paradigm

Participants were administered several anxiety and phobia questionnaires, followed by a mock scanner session during which they practiced the experimental task. Each trial began with an anticipation period signaled by a cue. An S preceded snake videos, an F preceded fish videos, and a D preceded disgust videos. Subjects were instructed at the onset of the study that they would be receiving these videos. All stimuli were countersynchronized to the cue. Uncontrollability was indicated by the color of the anticipation cue. A blue or yellow cue indicated a controllable trial, and the other half was indicated uncontrollable. When the 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 rated as uncontrollable and the other half controllable. A success rate of approximately 50% was achieved with online monitoring of RT by EMDR software. Each trial ended with one Likert online rating about the nature of the stimulus - valence, arousal, disgust, and fear - counterbalanced across conditions.

RESULTS

Anticipation

Figure 1. Phobics: Snake anticipation > Fish anticipation

ROI that distinguishes activity to viewing snake videos as compared to fish in the ACC, bilateral insula and bilateral amygdala. All differences are significant at p<0.005 (see Figure 3 for complementary video response data).

Uncontrollability

Figure 2. Phobics: Snake anticipation > Disgust anticipation

ROI that distinguishes activity to anticipation of a snake cue as compared to fish in the perigenual ACC, bilateral insula and bilateral amygdala. All differences are significant at p<0.005 (see Figure 4 for complementary video response data).

CONCLUSIONS

1. As predicted, anticipation of aversive events led to greater activation in the ACC, bilateral insula, amygdala and OFC. For the phobics, this was also the case for the anticipation of snake videos. The non-phobics predominantly showed anticipation effects for the disgust videos in comparison to the snake. Uncontrollability over video presentation resulted in larger neural responses than when video presentation could be controlled in phobics with elevated anxiety.

REFERENCES