Threat-Related Modulation of Functional Relations Between Limbic and Prefrontal Regions.

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Introduction

There is very little debate in the field of neurosciences that the amygdala is involved in various emotional changes or disorders (Dick 1996). Amygdalar involvement in vigilance and stress-related behaviors have been demonstrated across species (Dick & Whalen, 2003). Furthermore, functional coupling between parietal and amygdala regions during threat has been noted in parastriate activity, as well as in the regulation of emotions and behaviors associated with affective responding.

In this study we investigated new brain activity in the dorsal amygdala in relation to performance under different threatening conditions in freely moving, unanesthetized monkeys. Threat was manipulated by altering the actions of a human intruder. The experiment was done in the testing room, and all monkeys had a "No Eye Contact" (NEC) or "Have direct gaze" (ST) (Kalin & Shelton, 1989).

All correlations were done across subjects, investigating the relation between co-varied glucose activations over a 30 minute time period to the overall glucose. This was done in several areas.

Observations that the amygdala habituates quickly (Zald, 2002), suggest that over the course of 10 minutes, repeated trials would not produce significant differences in amygdalar activation. This was true, there was no significant difference between brain amygdala glucoses activations over a 30 minute time period in the dorsal amygdala.

Methods

Animals were given water ad libitum and were fed monkey chow every morning. Animal housing and experimental conditions were maintained in a constant environment. Animals were observed in a test cage for 30 minutes on 5 different days. After this adaptation regime was completed, each animal was housed separately and observed in the test cage for 30 minutes on 5 different days. After this adaptation regime was completed, each animal was housed separately and observed in the test cage for 30 minutes on 5 different days. After this adaptation regime was completed, each animal was housed separately and observed in the test cage for 30 minutes on 5 different days. After this adaptation regime was completed, each animal was housed separately and observed in the test cage for 30 minutes on 5 different days. After this adaptation regime was completed, each animal was housed separately and observed in the test cage for 30 minutes on 5 different days. After this adaptation regime was completed, each animal was housed separately and observed in the test cage for 30 minutes on 5 different days.

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Results Summary

Behavior

During NEC, the monkeys engaged in significantly more freezing behavior. In contrast, during ST monkeys demonstrated significantly more freezing behavior toward the experimenter, locomotion, and vocalizations.

Brain activity

During NEC, activity in the dorsal amygdala and parietal regions has not been noted in the anterior cingulate (areas 24 and 32) and dorsal cingulate (areas 24 and 32) and posterior parietal regions (39 and 40). During ST the relationship and emotional (NEC vs. ST) correlations are significant for the left amygdala and parietal clusters. There were no significant correlations between amygdala or parietal clusters and observed behaviors (p<.001).

Discussion

These findings are interesting because the adaptive response to NEC causes behavioral inhibition and increased anxiety, which is thought to involve anterior cingulate (Kalin et al., 1997). The adaptive response to ST causes an increase in locomotion, but is associated with protective behaviors. Furthermore, the negative relation between left amygdala and anterior cingulate may reflect inhibitory influences of PFC on amygdala that controls the shift from adaptive to emotional responses.

The results of this study suggest that the activity in amygdala and PFC is related to behavioral inhibition and emotional control. The adaptive response to NEC involves behavioral inhibition and constant monitoring of threat, whereas the adaptive response to ST involves the suppression of emotional responses. These findings are interesting because the adaptive response to NEC involves behavioral inhibition and increased anxiety, which is thought to involve anterior cingulate (Kalin et al., 1997). The adaptive response to ST involves the suppression of emotional responses.