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Age Effects on Regional Cerebral Blood Flow and Amygdala Activation ir Response to Fear Stress

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Development & Aging

Abstract

Introduction

The aging process is generally characterized by the progressive loss of neuronal and physiolog efficiency. One system that is impacted by the convergence of deficits in neuronal and physiol efficiency is the stress response system. Several reports suggest that during the aging process t are enhanced behavioral and neuroendocrine responses to stress. Recently, the exaggerated str response observed during aging has been associated with increased phobias. Therefore the pre studies were designed to explore cerebral blow flow changes responsible for metabolic suppor during neural signaling and the functional response associated with a fear eliciting stimulus (fo scent) in a rodent model of aging.

Methods

Young adult (3 -6 months) and old (18-24 months)Fisher344 male rats (300-400grams) were i on a 4.7 Tesla imaging scanner under 2%-isoflurane anesthesia. Anatomical images were acqu using the fast spin-echo pulse sequence (RARE) with TR = 2500ms (90o flip angle), 8 echo tra effective TE = 10 ms, matrix = 256 x 256, FOV = 2.56 x 2.56 cm2, and eight 1.5-mm slices.
Quantitative CBF was measured using the continuous arterial spin-labeling technique with fou segmented gradient-echo EPI, with matrix = 128x128, FOV = 2.56x2.56 cm2, TE = 15ms, TR (90o flip angle), and eight 1.5-mm slices. Functional activation data was obtained using the fas spin-echo pulse sequence (RARE) with TR = 2.4s, effective TE = 8 ms, matrix = 64 x 64, FOV 3.0 x 3.0 cm2, and eighteen1.0-mm slices, Repetition Number=60.
MR Image analysis employed codes written in Matlab (MathWorks, Natick, MA) and STIMU software (Strupp, 1996). Analysis was performed on conservative ROIs avoiding brain-skull interface which were carefully drawn based on CBF maps and functional maps.

Results & Discussion

Figure 1 depicts mean CBF values in old and young male Fischer rats (n=4/each). Whole-brai in old and young rats were1.31 [plus/minus] 0.04 and 1.68 [plus/minus] 0.13 ml/g/min, respec Regional CBF differences between the two groups were statistically different (*P<0.05, **p<0 CBF was spatially heterogeneous with values in the hippocampus and cortex showing highest significant differences between the young and old groups.
Figure 2 represents the average percent change in positive BOLD signal intensity in the amygc The old animals exhibited a significant increase in BOLD activation in response to fox scent (*p<0.05).

Conclusions:

In this report significant changes in cerebral blood flow accompanied aging in several regions interest. In spite of these decreases, there was enhanced BOLD activation in response to fear st

in the amygdala – a region central to the fear response- in the aged animals. We hypothesize th
independent of observed changes in cerebral blood flow that accompanies the aging process, o
animals can still mount a significant (if not exaggerated) response to life threatening stressors.

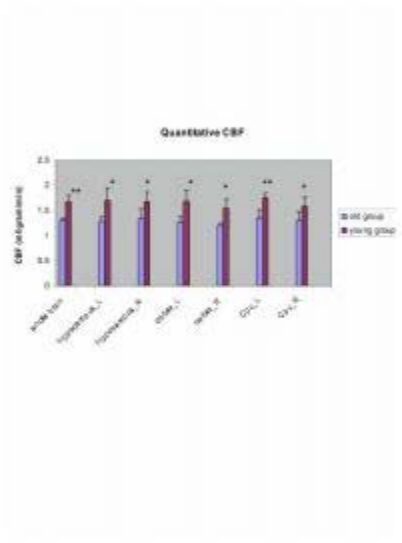

Figure 1

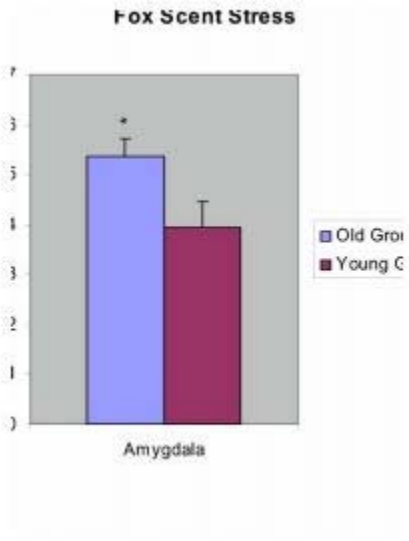

Figure 2

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