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ABSTRACT INFORMATION
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Abstract Title: **Multiparametric structural brain connectivity and suicidal ideation in adolescents**

Abstract Summary:

We applied diffusion MRI-based connectomics with different weighting schemes to investigate neural correlates of suicidal ideation in adolescents. We obtained preliminary evidence for positive correlations between structural connectivity of the amygdala with orbitofrontal cortex and suicidal ideation scores. Fractional anisotropy weighting and the ratio of T1/T2-weighted images yielded similar results.

Abstract

Introduction

Suicide is the second leading cause of death among those 15 to 29 years old in the United States[1]. Reducing suicide and suicide attempts among adolescents is therefore a key public health priority. Previous neuroimaging studies have shown that suicide attempters exhibit structural brain alterations in the orbitofrontal cortex (OFC) and amygdala[2]. It has also been shown that resting state functional connectivity (RSFC) of the amygdala with several brain regions including the OFC is higher in suicide attempters, and that it correlates with suicidal ideation[3]. Projections from the amygdala to OFC convey the emotional significance of external stimuli; while, in turn, a massive projection from orbitofrontal cortex to the intercalated masses of the amygdala results in disinhibition of the hypothalamus, which triggers autonomic responses[4]. Repeated activation of this pathway may lead to over-sensitization and resulting emotional hyperreactivity which is implicated in suicidality. The aim of this study was to assess the relationship between the structural connectivity of the amygdala with the OFC and suicidal ideation in adolescents.

Methods

A community sample of 17 adolescents (16.3±1.1 years, range 14-18 years, 7F/10M) underwent a 3T MRI scan including a T1-weighted, a T2-weighted, and a diffusion-weighted sequence with 55 directions. A quality assurance step was implemented to reject diffusion directions corrupted by motion[5]. Fiber tracts were reconstructed via deterministic high angular resolution diffusion imaging (HARDI)-based tractography using Diffusion Toolkit (Fig. 1a). Two regions were defined as structurally connected if at least two fiber tracks were present with a length greater than 5mm [6]. Mean fractional anisotropy (FA) and T1w/T2w ratio as a potential indicator of myelination[7] were used as connection weights. Suicidal ideation was assessed using the Suicidal Ideation Questionnaire-Junior (SIQ-Jr).

Results

Two subjects had to be excluded due to non-identifiable tracks. Overall, the number of rejected diffusion directions ranged from 1 to 13 (mean=5.8±3.2 directions). We observed positive correlation coefficients between the structural connectivity of the orbitofrontal cortex with the amygdala and the

SIQ-Jr scores for both weighting schemes, FA and T1w/T2w: FA: left r=.23, p=.38, right r=.47, p=.38; T1w/T2w: left r=.23, p=.37, right r=.36, p=.15.

Conclusions

Our data provide preliminary evidence supporting our hypothesis that suicidal ideation has a positive association with the structural connectivity between amygdala and OFC in adolescents. This association could indicate a hyperconnectivity of this pathway that is related to emotional hyperreactivity[4]. Both weighting schemes showed sensitivity to the link between suicidal ideation and structural connectivity in adolescents and yielded similar results. This indicates that the T1w/T2w ratio may serve as useful marker of structural connectivity. The small sample size could explain why the associations did not reach statistical significance. REFERENCES [1] Klonsky et al. Annu. Rev. Clin. Psych. 2016;12:307-330. [2] Monkul et al. Mol. Psych. 2007;12:360-366. [3] Kang et al. Prog. Neuropsychpharm. Biol. Psych. 2017;77:222-227. [4] Barbas, J. Anatomy, 2007;211(2):237-249. [5] Tymofiyeva et al. Plos One 2012;7(2). [6] Quin et al., MRM 2014;72:1397-1407. [7] Nakamura et al. Annals of Neurol. 2017;82:635-39.

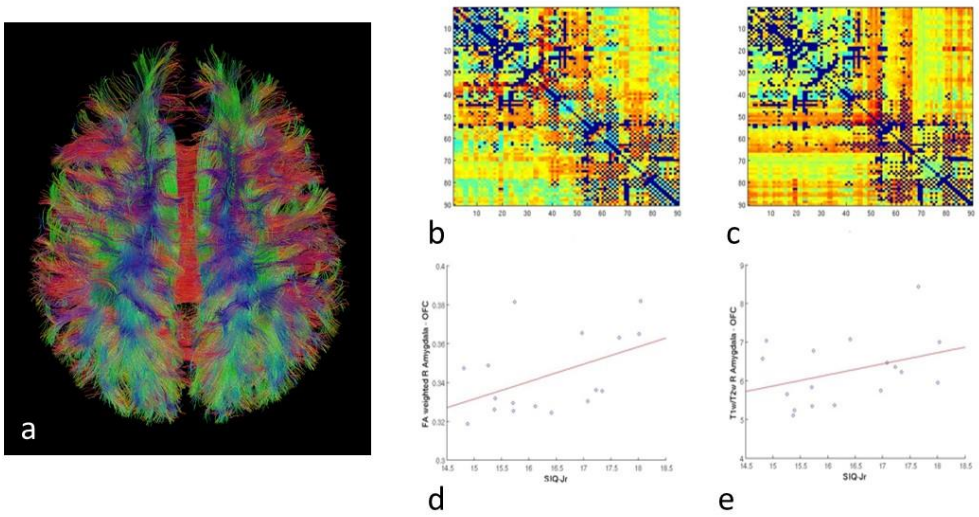

Fig 1. A) Example tractogram reconstructed using HARDI. B) Connectivity matrix using FA weighting. C) Connectivity matrix using T1w/T1w weighting. D) Scatterplot of FA-weighted R Amygdala – OFC connectivity and SIQ-Jr. E) Scatterplot of T1w/T2w-weighted R Amygdala – OFC connectivity and SIQ-Jr