Reduced Hippocampal Volume in Comorbid Alcohol Use Disorder and Major Depression

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Abstract: Previous research indicates that people with Major Depressive Disorder (MDD) and/or Alcohol Use Disorder (AUD) have smaller hippocampal volume compared to people without the disorders. Many studies looking at the effects of MDD controlled for the presence of AUD, while a majority of studies looking at AUD did not control for the presence of MDD. We examined whether the comorbidity of AUD and MDD plays a role in the hippocampal volume decrease that has been associated with both disorders in a sample of N = 411 adult twins classified into one of four groups: (1) MDD and no AUD (n = 97), (2) AUD and no MDD (n = 70), (3) MDD/AUD (n = 61), and (4) No MDD or AUD (n = 195). The four groups did not have any significant differences in hippocampal volume when compared to each other. There was a significant negative association found with the alcohol use index in females. The nonsignificant results between groups might reflect a lack of current depressive symptomology in the sample, a possibility we will explore in future research.

Introduction

- The hippocampus is a vital limbic structure involved in learning, memory, and emotion regulation (Labar & Cabeza, 2008) and is one of only two brain structures where neurogenesis is known to occur after infancy and into adulthood (van Praag et al., 2002)
- MDD has been correlated with smaller hippocampal volume (Campbell, Marriott, Nahmias, & MacQueen, 2004)
- Problematic alcohol use has been shown to decrease hippocampal volume through exposure-related effects, especially in females (Wilson et al., 2017)
- AUD and MDD have a high comorbidity rate (Burns & Teesson, 2002)

Purpose

The purpose of this study is to compare four groups (1) MDD (but no AUD), (2) AUD (but not MDD), (3) AUD and MDD, or (4) no AUD or MDD to determine whether comorbidity of AUD and MDD plays a role in the hippocampal volume decrease that are associated with both disorders.

Methods

Participants

- 411 twins were used in this study: (1) MDD and no AUD (n = 97), (2) AUD and no MDD (n = 70), (3) MDD/AUD (n = 61), and (4) No MDD or AUD (n = 195)

Measures

- Diagnostic Interviews were conducted at age 24 (Keyes et al. 2008)
- The Substance Abuse Module (SAM) portion of the Composite International Diagnostic Interview (CIDI) were used to assess recent problematic alcohol use
- The Structured Clinical Interview for the DSM (SCID) was used to assess MDD; the Inventory of Depression and Anxiety Symptoms (IDAS) was used to assess recent depressive symptoms

Neuroimaging

- Imaging data were collected using Siemens 3T Tim Trio and Prisma Scanner- images were normalized and manually reviewed before processing
- The standard FreeSurfer pipeline was used to segment cortical and subcortical structures, including the hippocampus

Data Analysis

- Conducted linear mixed models (LMM) to look at group differences with left and right hippocampal volume
- Covariates accounted for are total brain volume, age, sex, and zygosity

Results

- A significant negative association was found with the alcohol use index, specifically in females, as opposed to an AUD diagnosis
- No association was found between depressive symptoms and hippocampal volume both since the last assessment or in the last year

Discussion

- Results may be nonsignificant due to only having a small subset of participants that had current depressive symptoms
- Lack of current depression might have limited our ability to detect a significant effect of depression on hippocampal volume; Questionnaire ask participants to focus on a two-week period since the last assessment 7 years beforehand
- Alcohol use may affect the hippocampus differently between genders, especially in relation to the alcohol use index

Future Research

- Assess hippocampal volume in participants who meet diagnostic criteria for current MDD or who are experiencing current elevated depressive symptoms and increase sample size
- Larger sample sizes could be used in diagnostic groups, especially to look at differences between gender
- Use co-twin control model-to further evaluate whether alcohol use causes reduced hippocampal volume in females, the hippocampal size of the twin who drinks more can be compared to its size in the co-twin who drinks less to determine if the size is reduced more in the heavier drinking twin

Selected References