



Research report

Deviant functional activation and connectivity of the right insula are associated with lack of awareness of episodic memory impairment in nonamnesic alcoholism

Anne-Pascale Le Berre^a, Eva M. Müller-Oehring^{a,b}, Tilman Schulte^b,
Matthew R. Serventi^{a,b}, Adolf Pfefferbaum^{a,b} and Edith V. Sullivan^{a,*}

^a Department of Psychiatry and Behavioral Sciences, Stanford University School of Medicine, Stanford, CA, 94305, USA

^b Neuroscience Program, SRI International, Menlo Park, CA, 94025, USA

ARTICLE INFO

Article history:

Received 28 November 2016

Reviewed 12 February 2017

Revised 10 April 2017

Accepted 16 July 2017

Action editor Asaf Gilboa

Published online 25 July 2017

Keywords:

Alcoholism

Anosognosia

Brain

Metamemory

Functional MRI

ABSTRACT

A disorder of metamemory, expressed as unawareness of mnemonic ability, is typically associated with the profound amnesia of Korsakoff's Syndrome (KS). A similar but less severe type of limited awareness can also occur in non-KS alcoholism and is observed as an impairment in generating Feeling-of-Knowing (FOK) predictions about future recognition performance. We previously found that FOK accuracy was selectively related to volumes of the insula in alcoholics involved in the present study. Unknown, however, are the neural substrates of unawareness of memory impairment in alcoholism. A task-activated fMRI paradigm served to identify neural nodes and networks implicated in inaccurate self-estimation of mnemonic ability in sober alcoholics while they made prospective FOK judgments in an episodic memory paradigm. Lower activation in the right insula correlated with greater overestimations of future memory abilities in alcoholics. Weaker connectivity of the right insula with the left dorsal anterior cingulate cortex, a node of the salience network, and stronger connectivity of the right insula with the right ventromedial prefrontal cortex (vmPFC), a node of the default mode network (DMN), co-occurred in alcoholics relative to the controls. Specifically, alcoholics, who failed to desynchronize insula-vmPFC activity, had greater overestimation of their memory predictions and poorer recognition performance. This study provides novel support that deviant functional activation and connectivity involving the right insula, a hub of the salience network, appears to participate in disrupting metamemory functioning in alcoholics. Compromised FOK performance might result from disturbance of the switching mechanism between brain networks serving self-referential processes (i.e.,

* Corresponding author. Stanford University School of Medicine, Department of Psychiatry and Behavioral Sciences, 401 Quarry Road, Stanford, CA, USA.

E-mail address: edie@stanford.edu (E.V. Sullivan).

<http://dx.doi.org/10.1016/j.cortex.2017.07.016>

0010-9452/© 2017 Elsevier Ltd. All rights reserved.

DMN network) and networks serving externally-driven activities like memory monitoring (i.e., fronto-parietal network). Thus, compromise in insular network coupling could be a neural mechanism underlying anosognosia for subtle mnemonic impairment in non-amnesic alcoholism.

© 2017 Elsevier Ltd. All rights reserved.

1. Introduction

On formal testing, individuals with Alcohol Use Disorder (AUD) are commonly observed to have mild to moderate cognitive impairment involving episodic memory—the mnemonic system responsible for encoding, storing, and retrieving personally experienced events (Fama, Pfefferbaum, & Sullivan, 2004; Oscar-Berman et al., 2014; Pitel et al., 2007). Although typically associated with the profound amnesia of Korsakoff's Syndrome (KS), limited awareness can be observed in alcoholics without neurological complication for their episodic memory deficits, a metamemory disorder (Le Berre et al., 2010; Le Berre et al., 2016). The limited awareness of mnemonic impairment may promote unawareness of functional compromise and undermine treatment efforts by engendering the false belief that nothing is wrong to be fixed.

Personal knowledge about one's own ability to remember and recall information, the process of metamemory, has implications for the accuracy of memory monitoring and control and for the efficient use of memory skills in everyday life (Flavell, 1971; Nelson & Narens, 1990). Abstinent alcoholics have been reported to make accurate judgments in retrospective confidence ratings of actual recognition performance (i.e., Retrospective Confidence Judgment, RCJ) but to be inaccurate in assessing future recognition performance for episodic information (i.e., Feeling-of-Knowing judgments, FOK) (Le Berre et al., 2010; Le Berre et al., 2016). Our previous studies have shown that alcoholics exhibited a tendency to overestimate their prediction of future episodic memory performance, believing themselves capable of accurately recognizing information when they subsequently failed to do so. We have assumed that this cognitive dissociation of intact RCJ with impaired FOK in uncomplicated alcoholism is consistent with a secondary mnemonic anosognosia (Le Berre et al., 2016). In other words, when alcoholics fail to consolidate newly updated information about their memory abilities into their semantic and autobiographical personal long-term knowledge database, they then compare their current memory functioning to outdated self-beliefs (Le Berre & Sullivan, 2016; Morris & Mograbi, 2013).

The neural substrates of component mnemonic processes relevant to metamemory have been investigated in few other studies. Using an episodic FOK paradigm, a recent paper reported that structural integrity of the right insula supported memory awareness in a mixed group, which included patients with mild Alzheimer's disease and cognitively healthy older adults (Cosentino et al., 2015). Similarly, we found that FOK accuracy was selectively related to volumes of the insula in the uncomplicated alcoholics involved in the present study

(Le Berre et al., 2016). Because the insula has been identified as a critical neural substrate of multiple components of self-awareness (Craig, 2009; Schmitz & Johnson, 2007), we posited that prospective episodic FOK implicates online memory monitoring mechanisms and additional self-referential processes to generate accurate future estimations. Structural damage in the medial prefrontal cortex also plays a critical role in disturbing episodic FOK accuracy as demonstrated in patients with frontal brain damage (Modirrousta & Fellows, 2008; Schnyer et al., 2004). Further evidence provided by a functional neuroimaging study (Schnyer, Nicholls, & Verfaellie, 2005) revealed that accuracy in episodic FOK predictions in healthy subjects may be supported by a multi-functional, left fronto-temporal brain network: the inferior prefrontal cortex for the creation of cues activating information in memory, the hippocampus and temporal cortex for storage and retrieval memory contents, and the ventromedial prefrontal cortex for ensuring the 'monitoring' of these retrieval processes in memory. Further, brain activity in several frontal and also parietal cortices appeared to be modulated by FOK engagement in healthy control participants, with greater regional BOLD signal evident for high level of FOK and lower cortical activity evident for lower FOK (Chua, Schacter, & Sperling, 2009; Elman, Klostermann, Marian, Verstaen, & Shimamura, 2012; Maril, Simons, Mitchell, Schwartz, & Schacter, 2003; Schnyer et al., 2005).

To date, functional neural substrates of unawareness of memory impairment in alcoholism have not been systematically investigated. Thus, the aim of this task-activated fMRI study was to identify neural nodes and networks implicated in inaccurate self-estimation of mnemonic ability in sober alcoholic patients. Accordingly, we sought patterns of brain activation and functional connectivity between regions of interest evoked while making prospective metamemory judgments (i.e., FOK judgments) during an episodic memory paradigm. Further, we explored whether these brain activation and functional connectivity patterns during predictions of future recognition performance could contribute to subsequent memory performance, especially because efficient metamemory skills are implicated in efficient use of memory skills in daily life activities. Previously, we demonstrated that the insula was a key selective structural brain substrate of FOK accuracy in sober alcoholics participating in the present study (Le Berre et al., 2016). Herein, we used functional imaging to test the hypothesis that attenuated activation of the insula and compromised insula functional connectivity would contribute to overestimation of memory performance by uncomplicated alcoholics.

Download English Version:

<https://daneshyari.com/en/article/5044519>

Download Persian Version:

<https://daneshyari.com/article/5044519>

[Daneshyari.com](https://daneshyari.com)