Psychiatry Research: Neuroimaging 213 (2013) 202–209

Contents lists available at SciVerse ScienceDirect

Psychiatry Research: Neuroimaging

journal homepage: www.elsevier.com/locate/psychresns

Readiness to change and brain damage in patients with chronic alcoholism

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ARTICLE INFO

Article history:
Received 1 November 2012
Received in revised form
11 March 2013
Accepted 24 March 2013

Keywords:
Alcoholism
Brain morphology
Motivation
Frontal cortex

ABSTRACT

High motivation to change is a crucial triggering factor to patients' engagement in clinical treatment. This study investigates whether the low readiness to change observed in some alcoholic inpatients at treatment entry could, at least partially, be linked with macrostructural gray matter abnormalities in critical brain regions. Participants comprised 31 alcoholic patients and 27 controls, who underwent 1.5-T magnetic resonance imaging. The Readiness to Change Questionnaire, designed to assess three stages of motivation to change (precontemplation, contemplation and action stages), was completed by all patients, who were then divided into "Action" (i.e. patients in action stage) and "PreAction" (i.e. patients in precontemplation or in contemplation stage) subgroups. The PreAction subgroup, but not the Action subgroup, had gray matter volume deficits compared with controls. Unlike the patients in the Action subgroup, the PreAction patients had gray matter abnormalities in the cerebellum (Crus I), fusiform gyri and frontal cortex. The low level of motivation to modify drinking behavior observed in some alcoholic patients at treatment entry may be related to macrostructural brain abnormalities in regions subtending cognitive, emotional and social abilities. These brain volume deficits may result in impairment of critical abilities such as decision making, executive functions and social cognition skills. Those abilities may be needed to resolve ambivalence toward alcohol addiction and to apply "processes of change", which are essential for activating the desire to change problematic behavior.

1. Introduction

The psychological treatment of alcohol abuse and dependence is generally based on two main clinical approaches, which may be jeopardized by cognitive deficits arising from alcoholism-related brain damage. The first approach is cognitive behavioral therapy (Berglund et al., 2003; Assanangkornchai and Srisurapanont, 2007; Clay et al., 2008), which aims to help patients recognize, avert or cope with high-risk relapse situations. The second approach (which can be combined with the first one) is motivational interviewing (Hettema et al., 2005; Miller and Rose, 2009), which is intended to initiate and develop an intrinsic motivation to change addictive behavior. Motivational interviewing has a patient-centered and directive therapeutic style, which helps patients explore and resolve their ambivalence towards changing their behavior (Miller and Rollnick, 1991). High motivation to change is a crucial triggering factor for patients' engagement in clinical treatment (DiClemente et al., 1999).

Motivational interviewing is based on the idea that alcoholic patients go through different stages of readiness to change their drinking behavior. According to the Transtheoretical Model (TTM) of intentional behavior change (Prochaska and DiClemente, 1983; DiClemente, 2007), change consists of a cycle of five stages of motivation. The first three "PreAction" stages preceding the effective implementation of actions in addiction change include "Precontemplation" (substance misuse and no intention of stopping drinking), "Contemplation" (strong intention of changing addictive habits but ambivalent attitude) and "Preparation" (initiation of planning for change, sometimes accompanied by initiatives to reduce or stop alcohol consumption). The two last stages correspond to "Action" (cessation of excessive alcohol consumption and adoption of previously envisaged healthier lifestyle) and finally "Maintenance"

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http://dx.doi.org/10.1016/j.pscychresns.2013.03.009

(integration of new behavioral habits in daily life over time and prevention of relapse). Ideally, patients in alcohol treatment should be willing and ready to change and therefore be in the "Preparation" stage (Prochaska, 2008).

The shift from a low to a high level of motivation to change drinking behavior involves patients completing a "decisional balance" (Janis and Mann, 1977). Addictive behavior is characterized by ambivalence, as patients endlessly weigh the advantages and disadvantages of changing. Patients hesitate between their "limbic" driven addictive behavior (i.e., impulsive decision making system) and more controlled behavior subtended by frontal lobe activity (i.e., reflective decision making system) (Crews and Boettiger, 2009; Verdejo-Garcia and Bechara, 2009). High motivation to change drinking behavior implicates effective decision making skills and executive functioning, which both involve the frontal cortex.

According to the TTM, in order to increase their readiness to change, patients must also apply so-called "processes of change", namely the overt and covert activities in which individuals engage when attempting to modify problematic behavior (Prochaska and DiClemente, 1983). More particularly, to progress through the "PreAction" stages, patients need experiential (cognitive-affective) activities that enable them to change the way they think and feel about their alcohol abuse. Blume et al. (2005) have postulated that verbal memory performance contributes to the process of change known as "consciousness raising" (i.e., gaining knowledge and information about the problem behavior and the advantages of changing). "Dramatic relief" (experiencing and expressing feelings about the problem behavior and solutions) and "environmental reevaluation" (assessing how the problem behavior affects the physical and social environment) are two other processes that rely not only on cognitive functions but also on emotional and social skills, including facial affect perception, theory of mind (Premack and Woodruff, 1978) and empathy (Eslinger, 1998).

Several studies have shown that patients with alcohol or drug abuse who seek or participate in treatment are at different stages of change (DiClemente and Hughes, 1990; Carney and Kivlahan, 1995; Edens and Willoughby, 2000). Sometimes, alcoholic patients are open to participating in treatment without being genuinely ready to abstain from alcohol. This clinical observation was confirmed in our previous behavioral study (Le Berre et al., 2012) conducted with the same clinical population of alcoholic patients as in the present study, i.e. after detoxification and at alcohol treatment entry. The investigation of the stage of change reached by each patient using the "Readiness to Change Questionnaire" revealed that some patients were still in the earlier precontemplation and contemplation stages while others were in the action stage. Since this heterogeneity in motivational level at treatment entry could be explained by cognitive factors, the aim of this previous study was to determine the contribution of several cognitive processes in the different motivational stages. Stepwise regression analysis revealed links between verbal episodic memory impairment and high precontemplation scores, as well as relationships between weak executive performance and high contemplation scores, and between good decision making skills and high action scores. Those results suggest that a set of complementary cognitive abilities such as memory, executive functions and decision-making skills may be needed to achieve awareness and resolve ambivalence towards alcohol addiction, which are essential for activating the desire to change problematic behavior.

In the present study, we aimed at going further in the understanding of the factors that could explain the heterogeneity in the motivational level of alcoholics at treatment entry. Our main objective was therefore to investigate whether the low readiness to change observed in some alcoholic inpatients at treatment entry could, at least partially, be related to macrostructural gray matter (GM) abnormalities in critical brain regions involved in cognitive, emotional and social skills (Le Berre et al., 2012), and affected by the harmful effects of chronic alcohol consumption (Jernigan et al., 1991; Kril et al., 1997; Moselhy et al., 2001; Chanraud et al., 2007). More specifically, the compromised motivation to change problematic drinking behavior observed in some alcoholic patients may be related to macrostructural abnormalities in the frontostriatal, frontocerebellar and medial temporal limbic systems.

2. Methods

2.1. Participants

Two groups of participants were included in this study: 31 patients with chronic alcoholism who were early in abstinence at clinical alcohol treatment entry and 27 control participants recruited by advertisement and word of mouth and drawn from our imaging database matched for age, t (56)=−0.34, p=0.73 (Table 1). All participants were volunteers to participate in the clinical treatment. None of the patients were court mandated or under family pressure in order to avoid any bias on their motivation level to change their alcoholic behavior. The neuroimaging data were collected in the same magnet and using the same imaging protocol for all participants (Kalpouzos et al., 2008, 2009). All the control subjects were selected according to stringent prospective inclusion/exclusion criteria and their enrollment was based on the absence of abnormality in clinical, magnetic resonance imaging (MRI) and neuropsychological examinations (Kalpouzos et al., 2008, 2009). None of the participants (alcoholic patients and controls) were taking psychotropic medication, had a history of drug misuse, displayed psychiatric problems or had any history of pathology (head injury, coma, epilepsy, Wernicke's encephalopathy, cirrhosis or depression) that might have affected their cognitive functions. Control participants were interviewed to check that they did not meet the criteria for alcohol abuse or dependence according to the DSM-IV criteria. All the participants gave their informed consent to the study, which was approved by the local ethics committee.

Alcoholic patients were recruited by clinicians on the basis of the DSM-IV criteria for alcohol dependence (American Psychiatric Association, 1994) while they were receiving treatment for alcohol dependence as inpatients at Caen University

Table 1
Participants' main demographic, clinical and alcoholic features.

	Controls	Alcohol-dependent patients
Number	27	31
Women/men	12/15	5/26
Age	44.80 (11.35)	43.87 (6.97)
Range	29–60	31–56
Years of education	–	10.77 (2.14)
Range	–	6–15
Vocabulary subtest (WAIS)*	–	6.90 (2.52)
Range	–	3–13
MMSE	–	27.35 (1.68)
Range	–	24–30
Beck depression inventory	–	7.68 (3.49)
Range	–	0–14
State-Trait Anxiety Inventory "State anxiety" (STAI Y-A)	–	33.84 (9.89)
Range	–	20–54
State-Trait Anxiety Inventory "Trait anxiety" (STAI Y-B)	–	50.77 (14.41)
Range	–	22–74
Smoking status (number of cigarettes per day)	< 10	20.94 (15.28)
Range	–	0–60
Days of abstinence before inclusion	N/A	12.64 (7.16)
Range	–	7–40
Years of alcohol use	N/A	28.19 (8.45)
Range	–	14–51
Years of alcohol misuse	N/A	15.42 (10.12)
Range	–	2–37
Years of alcoholism	N/A	8.26 (8.26)
Range	–	0.5–33
Quantity per day (in units of alcohol)	N/A	21.95 (11.70)
Range	–	3.5–53.57
Number of withdrawals	N/A	2.42 (1.54)
Range	–	1–8

Data are shown as means (standard deviations).

* Standard T scores.