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Mental state decoding and mental state reasoning in recently detoxified alcohol-dependent individuals

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ABSTRACT

Impaired social cognition has been associated with interpersonal problems and with the development of and relapse into alcohol abuse. In the present study, self-reported trait empathy, decoding of complex mental states and cognitive and affective mental state reasoning were assessed in alcohol-dependent participants, and the association with executive function and psychopathological characteristics was investigated. Twenty recently detoxified alcohol-dependent patients and 20 matched healthy controls were assessed with an abbreviated German version of the Interpersonal Reactivity Index, the Revised Reading the Mind in the Eyes Test, the Faux Pas Story Test, the Trail Making Test and the Letter–Number-Sequencing Test. Patients were impaired relative to controls with regard to mental state decoding on the Eyes Test and showed reduced faux pas detection and impaired mental state reasoning reflected by lower faux pas understanding and faux pas empathy scores. There were no group differences regarding self-reported trait empathy. Performance on the sociocognitive measures was related to executive functioning and the severity of depressive symptoms. Although self-report measures might not always reliably detect impairments of social cognition, behavioural measures suggest pronounced impairments of mental state decoding and mental state reasoning in association with alcohol dependence. Findings ought to be incorporated into current treatment strategies.

1. Introduction

Chronic alcohol abuse has been related to a dysfunction of the prefrontal cortex and to associated executive impairments (Giancola and Moss, 1998; Lyvers, 2000; Oscar-Berman and Marinkovic, 2007; Abernathy et al., 2010; Goldstein and Volkow, 2011). Particularly the medial portions of the prefrontal cortex have also been linked to social and affective functioning (Frith, 2007). More recent investigations of alcohol dependence have thus taken impairments of these domains into account, as they can detrimentally affect interpersonal relationships. This may contribute to the development of and relapse into alcohol use disorder (Zywiak et al., 2003; Hunter-Reel et al., 2009) and to the social stigma associated with this disorder (Pescosolido et al., 2010).

According to Tager-Flusberg and Sullivan (2000), complex social processing is thought to involve at least two stages: mental state decoding and mental state reasoning. Mental state decoding, termed the social-perceptual component of social cognition by the authors, is thought to involve more basic processes such as person perception and knowledge. This allows the individual to make rapid inferences about other people's mental and emotional states based on immediately available perceptual information, e.g. derived from facial, body or vocal expressions as well as from motion or actions. The second social-cognitive component, mental state reasoning, incorporates what has traditionally been known as "theory of mind", a capacity enabling us to understand other people's minds in terms of a representational system. Mental state reasoning is thought to be more closely linked to linguistic abilities and to other higher-order cognitive functions such as executive control, and usually requires the integration of contextual knowledge about the target person. The distinction between the two components has been supported by data from lesion and neuroimaging studies, suggesting the amygdala and associated regions in the medial temporal cortex as neural substrates of mental state decoding and the prefrontal cortex as a primary correlate of mental state reasoning. Usually, both components work in concert to ensure reliable judgements about the mental state of others (see Tager-Flusberg and Sullivan, 2000).

As far as mental state decoding is concerned, numerous studies have linked impaired recognition of emotional faces (Townshend and Duka, 2003; Foisy et al., 2007; Maurage et al., 2008, 2009; Kornreich et al., in press), body postures (Maurage et al., 2009), voices (Monnot et al., 2001, 2002; Uekermann et al., 2005;

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Maurage et al., 2009; Kornreich et al., in press) and even music (Kornreich et al., in press) to alcohol dependence. Patients not only tend to mislabel emotional expressions but also appear to need higher expression intensities to be able to identify them as being emotional and not neutral (Frigerio et al., 2002). Maurage et al. (2011b) showed that alcohol-dependent patients were impaired relative to healthy volunteers on the Reading the Mind in the Eyes Test (RMET: Baron-Cohen et al., 2001), a task supposed to assess the ability to decode basic and complex positive and negative emotions based on pictures of the eye region only. Interestingly, reduced activation of the left inferior frontal gyrus and the right middle temporal gyrus was reported in offspring from multiplex alcohol dependent families working on the RMET, in spite of intact behavioural performance (Hill et al., 2007). This suggests that deviant neural processing associated with complex mental state decoding might serve as a trait marker of alcohol dependence proneness. Alcohol-dependent patients continue to show impaired emotion recognition even after mid- to long-term abstinence (Kornreich et al., 2001) and heavy and prolonged alcohol consumption not only seems to impair the ability to decode other people's mental and emotional states but also the capacity to correctly identify one's own emotions, a deficit termed alexithymia (Taieb et al., 2002). Although the predictive utility of alexithymia in relation to the risk for the development of alcohol dependence has been questioned, it might interfere with treatment outcomes (see Thorberg et al., 2009).

Only a relatively small number of studies addressed more complex domains of social cognition (see Uekermann and Daum, 2008 for a review), which would rather fall within the realm of mental state reasoning. For instance, alcohol-dependent patients have been shown to be impaired on conditional reasoning, particularly when they were asked to detect incorrect conditional rules in social contracts (e.g. "*If you borrow the car*, *then you must fill up the tank with gas*"). Social reasoning was not correlated with performance on the RMET as a measure of mental state decoding, which further highlights the validity of the dissociation between the two components of social cognition (Kornreich et al., 2011). Alcohol dependence has furthermore been associated with lower self-reported trait emotional intelligence (Riley and Schutte, 2003; Szczepanska et al., 2004; Kornreich et al., 2011), impaired theory of mind and with deficient humour processing, both in terms of reduced cognitive understanding and diminished affective appreciation of humorous punchlines (Uekermann et al., 2007). Another underexplored complex social cognition construct in relation to alcohol dependence is empathy which has been broadly defined as the cognitive and emotional reactions of one individual to the observed experiences of another person (Shamay-Tsoory, 2011). The concept is thus based on mental state decoding but can also involve aspects of mental state reasoning in situations where the use of contextual knowledge, e.g. about the perceived fairness of an individual (Singer et al., 2006) or the successful outcome of a painful treatment (Lamm et al., 2007), may modulate the empathic response of the observer. More recently, empathy is rather thought of as a multidimensional concept, encompassing both cognitive (mental perspective taking and the executive distinction between one's own and other people's emotional states) and affective (empathic concern for someone's well-being and one's own affective response to another person's emotions) components (Shamay-Tsoory, 2011). Previous studies have demonstrated a global impairment of self-reported trait empathy (Martinotti et al., 2009) as well as a dissociated pattern of impaired emotional empathy but intact cognitive empathy (Maurage et al., 2011b) in recently detoxified alcohol-dependent patients. Although these studies represent a valuable first assessment, self-report measures preclude firm conclusions about the actual performance on measures of mental and emotional state attribution, and they also do not require an online integration of contextual knowledge about a target person.

Taken together, a more thorough exploration, particularly of more complex social cognition, is required in current alcohol dependence research. In particular, as becomes obvious based on our review of the literature, there is a lack of studies addressing both mental state decoding and mental state reasoning in alcohol dependence, at the same time relating their findings to other higher-order cognitive abilities such as executive function. The very few studies that assessed mental state reasoning, such as the one by Uekermann et al. (2007), did not require the use of contextual knowledge about a situation to accomplish reasoning about another person's emotional states.

The primary goal of our study was to investigate both mental state decoding and mental state reasoning in alcohol-dependent patients. The ability to decode complex mental and emotional states was assessed both with a performance-based measure and in terms of a self-reported personality trait. The main focus of the present study was, however, on the assessment of cognitive and affective mental state reasoning, measured in terms of the ability to understand social faux pas situations using the Faux Pas Story Test (Stone et al., 1998). In terms of cognitive mentalizing, this test requires participants to detect that something inappropriate has been said and to understand that the faux pas has been committed unintentionally. Affective mentalizing/affective empathizing is involved in that the participant is required to understand that the faux pas may have a negative emotional impact on another person. Thus, an integration of both cognitive and affective aspects of social cognition is required along with the use of contextual knowledge about the situation as a whole (Shur et al., 2008).

A second goal of our study was to determine whether impaired mental state decoding and mental state reasoning might be associated with executive dysfunction. Similarly as executive function, mental state reasoning in particular relies on the integrity of the prefrontal cortex complex, and complex social processing is also thought to be based on working memory and cognitive flexibility (Uekermann et al., 2007). Given the prominent structural and functional deficits in medial prefrontal, orbitofrontal and temporal brain areas in alcohol dependence and the relevance of these structures for the sociocognitive domains targeted in our study (Stone et al., 1998; Hill et al., 2007; Uekermann and Daum, 2008; Maurage et al., 2011a) but also for executive and inhibitory control (Baler and Volkow, 2006), we expected a poorer performance of the patients relative to controls on all measures of social cognition as well as an association between executive dysfunction and performance on the sociocognitive measures.

2. Methods

2.1. Participants

We recruited twenty patients (ALC group) diagnosed with alcohol dependence according to the criteria of the International Classification of Disease (Dilling et al., 2000) (ICD 10, F.10.2) who were undergoing inpatient detoxification treatment in the Department of Psychiatry, LWL University Hospital Bochum. Testing occurred between the fourth and 14th day of treatment, but we aimed to ensure that acute withdrawal symptoms had already subsided by that time according to both the impression of the clinician in charge and patient self-report. The diagnosis was confirmed and comorbid diagnoses were excluded with the German version of the M.I.N.I PLUS International Neuropsychiatric Interview (Sheehan et al., 1998, administered by a senior psychiatrist (P.R.). Due to high co-occurrence and to increase the clinical validity of our study, a mild to moderate depressive episode (ICD 10, F32.0–F32.1/F33.0–F33.1) was accepted as a comorbid diagnosis in the ALC group. Eight ALC patients presented with a moderate depressive episode (F32.1 in seven patients, F33.1 in one patient). Patients were excluded if they presented with any other