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Research report

Facial emotion recognition and its correlation with executive functions in bipolar I patients and healthy controls

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ABSTRACT

Introduction: The ability to recognize facial emotions is altered in patients with Bipolar Disorder (BD) during mood episodes and even in euthymia, while cognitive functioning is similarly impaired. This recognition is considered a fundamental skill for successful social interaction. However, it is unclear whether the ability to recognize facial emotions is correlated with the cognitive deficits observed in BD.
Objective: The objective of this study was to evaluate Facial Emotion Recognition (FER) and its correlation with executive function (EF) in BD I patients during mania, depression and euthymia compared to healthy controls.
Material and methods: A total of 110 patients with BD I, 18–40 years old were included (41 in manic episode; 31 in depressive episode and 38 euthymic). Patients were assessed for FER and EF (Wisconsin card sorting test – WCST), along with 96 healthy volunteers (18–40 years old) recruited from the University of São Paulo.
Results: The results showed that BD I patients had lower FER performance compared to controls on fear subtests, happiness, the surprise test, and FER total scores. Moreover, BD I manic patients showed poorer performance for EF compared to controls. Six out of the seven variables of the WCST correlated with FER in both healthy controls and BD euthymic subjects but not in BD patients during mood episodes.
Conclusion: Cognitive deficits and difficulties recognizing facial emotions are present in all mood episodes in BD I patients, even during remission. Although FER is not considered a cognitive domain, these results suggest that, along with EF, it has a complementary function. Hence, further studies should investigate this issue in larger samples and verify whether these similarities also occur at a neurobiological level.

1. Introduction

Bipolar Disorder (BD) is a chronic and recurrent illness that has a severe impact on social and vocational functioning in about two-thirds of those affected (Huxley and Baldessarini, 2007; Wingo et al., 2010). Growing evidence has revealed that patients with BD may have lower performance in several cognitive domains, especially attention, memory and Executive Function (EF), and that these deficits persist even during clinical remission or euthymia (Malhi et al., 2007; Torres et al., 2007; Arts et al., 2008; Kurtz and Gerraty, 2009; Balanza-Martínez et al., 2010).

The EFs are top down processes that reflect neural efficacy in the prefrontal cortical regions (Fuster, 2001) and have been defined as the set of higher cognitive functions, considered essential for the control of information processing and coordination of behavior, being responsible for important activities such as resolution of problems, transformation of thought into decisions and planned actions (Luria, 1981; Lezak, 1995; Malloy-Diniz et al., 2010).

Despite the robust body of work on neuropsychological aspects of BD, research on social cognition remains scant and inconclusive. Social cognition is a multidimensional psychological domain involving a complex set of processes that enable adaptive social interaction, such as the representation of internal somatic states, knowledge about the self, perception of others, and interpersonal motivations (Amodio, 2006). Recent investigations in euthymic BD patients have reported dysfunctions in central processes within this construct: facial emotion recognition (Martino et al., 2008., 2011; Bozikas et al., 2007), theory of mind (Martino et al., 2011; Bora et al., 2005; Olley et al., 2005; Lahera et al., 2008; Montag et al., 2010; Wolf et al., 2010), and affective decision-making (Adida et al., 2011), as well as spared social-cognitive abilities (Rubinsztein et al., 2000; Clark et al., 2002; Harmer et al., 2002; Lembke and Ketter, 2002; Keightley et al., 2003; Venn et al., 2004; Martino et al., 2010).

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Emotion processing, a central aspect of social cognition, encompasses the ability to identify and discriminate 'basic emotions', which are thought to be innate and have universally recognizable facial expressions (Ekman and Friesen, 1976). Evidence for BD deficits in FER ranges from reports of no alterations and even improved recognition for disgust (Harmer et al. 2002), isolated fear recognition impairment (Lembke and Ketter, 2002; Venn et al., 2004), and a selective effect of mood state on surprise recognition (Rocca et al., 2009). However, in a recent meta-analysis, Kohler et al. (2011) concluded that FER impairments in BD represent a moderate and stable deficit that appears to be moderated by a limited number of demographic and clinical factors such as self-reported depression, age at time of testing, and years of education.

Although dysfunctions in both EF and FER have previously been reported, there is scant data linking these deficits. Recent evidence indicates that BD patients are unable to engage the prefrontal cortex when processing emotional stimuli (Lagopoulos and Malhi, 2011). Along these lines, Gopin et al. (2011) demonstrated impairment in BD I patients' ability to discriminate and respond accurately to positive and negative emotional stimuli in an executive task requiring the inhibition of a proponent response. Brand et al. (2012) found similar results in a group of unaffected bipolar siblings, where a response bias to negative emotional cues was observed. Similarly, Bora et al. (2005) reported that the ability to conceptualize another's mental/emotional state was positively correlated with measures of flexibility in a euthymic BD sample.

Indeed, the literature reports deficits of FER and EF in BD while some studies have correlated some measures of social cognition with EF functioning. However, it is unclear whether the impairment observed represents a generalized performance deficit, a problem processing emotional stimuli, or a specific deficit in FER (Bryson et al., 1997; Mandal et al., 1998; Marwick and Hall, 2008, Kohler et al., 2009). Given this data, the objective of the present study was to evaluate FER and its correlation with EF in bipolar I patients during mania, depression and euthymia compared to healthy controls.

2. Material and methods

2.1. Subjects

One hundred and ten individuals (18–40 years old) with BD I were included. Diagnoses were determined by trained psychiatrists based on the Structured Clinical Interview (SCID-I) (First et al., 1996) for DSM-IV TR (DSM-IV 2000). Euthymic patients ($n=38$) were stable without medication adjustment for at least 2 months. Manic ($n=41$) and depressive ($n=31$) subjects were medication free at the time of the neuropsychological evaluation. These symptomatic patients were participants in the LICAVAL clinical trial (Campos et al., 2010) and evaluated immediately after the wash-out period (at least 4 weeks for antidepressants, mood stabilizers or antipsychotics, or 8 weeks for depot medications), prior to commencing use of medications in the trial. Subjects with neurological disorders, previous head trauma, currently abusing any substance or submitted to electroconvulsive therapy in the preceding 6 months, were excluded. The Young Mania Rating Scale (YMRS) (Young et al.,1978), and the Hamilton Depression Rating Scale (HDRS-21) (Hamilton, 1960) were used to evaluate symptoms.

2.2. Control group

Ninety-six healthy volunteers (18–40 years old) were recruited, consisting of students or staff of the Faculty of Medicine, University of São Paulo. All control subjects had no current or past history of psychiatric disorders according to the evaluation conducted by trained psychiatrists using The Mini International Neuropsychiatric Interview (MINI) (Sheehan et al. 1998). Similarly, all subjects had no family history (first-degree relatives) of mood or psychotic disorders and had not been in recent use of psychotropic medication or indulged in substance abuse over the last 3 months.

2.3. Cognitive assessment

Neurocognitive and FER tests were carried out under standardized conditions and scored by two trained neuropsychologists. EF was assessed using the Wisconsin Card Sorting Test [(WCST)-Conceptual level responses (WCST-CONC), Perseverative Responses (WCST-PR), Failure to Maintain Set (WCST-FMS), Corrected Categories (WCST-CC), Errors (WCST-E), Non-Perseverative Errors (WCST-NP), and Perseverative Errors (WCST-P)] (Lezak, 1995). FER was tested using a range of photographs from the Ekman and Friesen series of Pictures of Facial Affect (Ekman and Friesen, 1976). The Emotion Hexagon Test is a test of FER utilizing pictures of emotional faces derived from Ekman and Friesen's Pictures of Facial Affect. Ekman and Friesen's original pictures were modified using computer manipulation techniques to generate stimuli of varying levels of difficulty. Each emotional face was blended with a picture depicting another emotion, which it was most likely to be confused with. For each emotion, three levels of intensity were generated: 90%, 70% and 50%. Each face was presented for 5 s, following which, participants were asked to decide which of the six emotions (happiness, sadness, surprise, disgust, anger and fear) best described the face. Participants completed a practice block followed by 5 test blocks of 30 trials each. Faces were presented in random order. Data from the practice block and stimuli at the 50% intensity level were not analyzed.

2.4. Ethics

The research ethics committee of the ***Hospital das Clínicas of the University of São Paulo*** approved the study (Process no. 2010/16934-4). Written informed consent was obtained from all study participants.

2.5. Statistical analysis

Subjects were classified into four groups (euthymia, mania, depression and controls). The Chi-square test was used for comparison of categorical data, and the ANOVA for continuous data.

Emotion Hexagon (HEX) scores (TOTAL, ANGER, DISGUST, FEAR, HAPPY, SAD AND SURPRISE) were compared among patients with euthymia, mania, or depression, and controls using the ANOVA test and subsequently by applying Turkey's multiple variables correction test. Pearson's correlation test was employed to investigate the impact of EF on FER scores. The PASW statistics version 18.0 software (SPSS Inc., Chicago, Illinois) was used for all analyses and a level of significance of <0.05 was adopted for all comparisons.

3. Results

A total of 110 patients with BD I (18–40 years old, 75 females) were included, of whom 41 were in manic episode; 31 depressive episode and 38 euthymic. Mean age of the sample was 29.3 (± 5.3) years old; 26.9 (± 5.2) years and 32.9 (± 10.9) years, respectively. Average schooling was 12.2 years (± 3.5) in mania, 12.6 years (± 2.4) in depression, 12.6 years (± 3.1) in euthymic state (Table 1).