Schizophrenia Research 165 (2015) 60–65

Contents lists available at ScienceDirect

Schizophrenia Research

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

Impaired facial emotion recognition in individuals at ultra-high risk for psychosis and with first-episode schizophrenia, and their associations with neurocognitive deficits and self-reported schizotypy

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ARTICLE INFO

Article history:
Received 10 January 2015
Received in revised form 17 March 2015
Accepted 22 March 2015
Available online 10 April 2015

Keywords:
Facial emotions recognition
Schizotypy
Ultra-high risk for psychosis
First-episode
Schizophrenia
Deficit
Neurocognition

ABSTRACT

Objective: This study aims to quantify facial emotion recognition abnormalities and their relation to neurocognitive dysfunction and schizotypy in individuals at ultra-high risk (UHR) for psychosis and patients with first-episode schizophrenia (FES).
Methods: Forty individuals at UHR for psychosis, 24 patients with FES and 46 normal controls performed a facial emotion recognition task that presented facial photographs encompassing all basic emotions. The perceptual aberration scale and revised social anhedonia scale were employed for self-reported assessment of schizotypy. An intellectual functioning (IQ) test and a broad battery of neurocognitive tests were conducted. Emotional task performance indexed by accuracy rate of specific emotion was compared among three groups. The correlation of accuracy rate with neurocognitive tests and schizotypy scales were analyzed within each clinical group.
Results: A recognition deficit of facial emotions was present in both clinical groups, even after adjusting for IQ and gender as covariates. This emotional deficit showed few significant relationships with broad range of individual neurocognitive measures. Meanwhile, this deficit demonstrated significant relationships with schizotypy, especially perceptual aberration in each clinical group.
Conclusions: Facial emotion recognition deficit may not only be present in FES patients, but may already have evolved prior to the onset of overt psychotic symptoms. This emotion recognition deficit may be linked to a perceptual aberration and largely independent of broad range of neurocognitive dysfunction.

1. Introduction

Facial emotion recognition, or the ability to infer others' emotional states, is essential for adaptive social interaction. Deficit in facial emotion recognition is a widely replicated finding in patients with schizophrenia, including first-episode patients (Edwards et al., 2001, 2002; Green et al., 2005; Addington et al., 2006; Kohler et al., 2010; Savla et al., 2013). This deficit is considered as a unique feature of schizophrenia, going beyond neurocognitive impairment (Edwards et al., 2001; An et al., 2003; Kohler et al., 2003, 2010), although there have been some contentions that emotional deficit may be secondary to general neurocognitive impairment (Kohler et al., 2000; Addington et al., 2006).

In recent years, facial emotion recognition deficit has been investigated in the putative prodromal, ultra-high-risk (UHR) phase of schizophrenia. Individuals at UHR, presenting attenuated but clinically meaningful psychotic symptoms have elevated risk of transition into frank psychosis (Yung and McGorry, 1996), while they are relatively less contaminated by secondary morbidity with chronic illness accompanied by marked neurocognitive decline (Fusar-Poli et al., 2012a). Impaired facial emotion recognition in individuals at UHR have been demonstrated in a number of investigations (Addington et al., 2008; van Rijn et al., 2011; Amminger et al., 2012a, 2012b; Green et al., 2012; Thompson et al., 2012; Wolwer et al., 2012) including a meta-analysis (Fusar-Poli et al., 2012b). Furthermore, impairment in facial

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http://dx.doi.org/10.1016/j.schres.2015.03.026
0920-9964/

emotion recognition has remained apparent even after adjusting for intellectual dysfunction (IQ) and/or psychopathology (van Rijn et al., 2011; Amminger et al., 2012a, 2012b; Comparelli et al., 2013; Bliksted et al., 2014) while it was also reported that social cognition and neurocognition are closely related in clinical high risk individuals (Yong et al., 2014). Because there has been growing evidence that social cognition and neurocognition are distinct constructs (Sergi et al., 2007; Green et al., 2008; Eack et al., 2010), facial emotion recognition deficit may be an independent disease-related marker, not just consequence of neurocognitive deficit.

As a potential intermediate phenotype, facial emotion recognition deficit has been investigated in line with schizotypy, which reflects genetic vulnerability to schizophrenia (Meehl, 1962, 1990). Previous studies reported that facial emotion recognition was related to the individual differences in psychometrically defined psychosis-proneness in nonclinical populations (Shean et al., 2007; Germine and Hooker, 2011; Abbott and Green, 2013) and adolescents with schizotypal personality disorder (Wickline et al., 2012). In particular, both self-reported scales of perceptual aberration and social anhedonia have been considered to be closely related with facial emotion recognition (Shean et al., 2007; Germine et al., 2011; Abbott and Green, 2013). Perceptual aberration measures the abnormal awareness of one's own body and blurring of self-boundaries (Chapman et al., 1978; Meehl, 1990). Since an ability to judge other's emotions was closely linked to subject's own emotional feeling elicited by other's facial expression (Buchanan et al., 2010), individuals who have aberrant perceptual experience and self-boundary problems may have more difficulty in recognizing and attributing one's emotions to other. Social anhedonia, characterized by lack of social pleasure and reduced desire to engage in social interaction (Chapman et al., 1994; Kwapil, 1998), has been suggested to be associated with neural mechanisms responsible for face emotion processing (Germine et al., 2011). Reduced capacity for hedonic experience in social situations may affect one's own emotional experience on facial expression of other, so it may be hard to exactly recognize other's emotion. Furthermore, perceptual aberration and social anhedonia have been considered as important indicators reflecting core features of schizotypy (Lenzenweger, 1994, 2006) and predicting increased risk for the development of psychosis (Chapman et al., 1994; Kwapil, 1998; Gooding et al., 2005). Thus, taken together, schizotypy including aberration of self-other discrimination and reduced hedonic capacity may play an important role in underlying mechanism of facial emotion recognition deficits in schizophrenia.

To date, the relationship between emotion recognition deficit and schizotypy along with comprehensive neurocognitive impairment has rarely been investigated in UHR individuals and first-episode schizophrenia (FES) patients. We hypothesized that there would be a facial emotion recognition deficit in both clinical groups, and then explored whether facial emotion recognition deficit was related to the broad battery of individual neurocognitive impairments. If this deficit is largely independent of neurocognitive impairment, it should be present beyond intellectual dysfunction and grossly uncorrelated with the broad battery of individual neurocognitive impairments in each clinical group. Finally, we also hypothesized that if facial emotion recognition deficit may be linked to inability to discriminate the self and other and/or reduced capacity to experience pleasure, this deficit should be associated to schizotypy scales of perceptual aberration and social anhedonia in each clinical group.

2. Methods

2.1. Participants

The present study was conducted as part of the Green Program for Recognition and Prevention of Early Psychosis (GRAPE) project in Seoul and details of inclusion and exclusion criteria are described elsewhere (An et al., 2010; Kang et al., 2014). Forty UHR individuals, 24 FES patients and 46 normal controls (NC) were invited to participate in this study between April 2008 and December 2011. All participants were evaluated and diagnosed using the Structured Clinical Interview for DSM-IV (SCID-IV; First et al., 1996a, 1996b). UHR individuals were diagnosed according to the Criteria of the Prodromal Syndromes from the Structured Interview for Prodromal Syndromes (SIPS; McGlashan et al., 2003) and met at least one of the three criteria of prodromal syndrome: (1) attenuated positive prodromal syndrome (APPS); (2) brief intermittent psychotic syndrome (BIPS); or (3) genetic risk and deterioration syndrome (GRDS). In FES patients, the mean duration of illness after developing frank psychotic symptoms was 9.5 (SD = 10.8) months. The recruitment of schizophrenia patients typically occurred about 1.5 months after hospitalization, as soon as outpatient maintenance medication levels had been stabilized. The majority (21/24) of FES patients were in a nearly-remitted state and their positive symptoms, assessed by the Scale for Assessment of Positive Symptoms (SAPS; Andreasen, 1984), were equivocal or at a mild level. The positive symptoms of the remaining (3/24) patients were moderate.

Written informed consent was obtained from all participants after the procedure had been fully explained and the study was reviewed and approved by the Institutional Review Board of Severance Hospital and Severance Mental Health Hospital. For participants under the age of 18 years, we also obtained the informed consent of their parents. Table 1 shows demographic and clinical profiles of the participants.

2.2. Procedures

The facial emotion recognition task consisted of 53 colored facial photographs. The facial stimuli were selected from standardized photographs of Japanese and Caucasian Facial Expressions of Emotion and Neutral Faces (Matsumoto and Ekman, 1988). This selection was based on the results of our previous standardization study (Ha et al., 2011) in a Korean cohort (n = 143) with a criterion of consensus from more than 70% of observers, which yielded eight happiness, eight surprise, seven sadness, six disgust, four anger, four fear, eight contempt and eight neutral facial photographs. This emotion task presented the stimuli in pseudorandom order to participants and asked them to "choose an emotional category that best describes the emotional state of the person in the photograph shown." A forced-choice format was used and the participant had to choose from the categories of happiness, surprise, sadness, disgust, anger, fear and contempt which were shown below the facial photograph. While eight neutral faces were also included, there was no choice for neutral among the responses. The stimulus presentation time was 7 s and another 7 s was allowed for choice of an emotional category.

Neurocognitive function was assessed using a broad battery of individual neurocognitive tests, as described in our previous study (Bang et al., in press). The battery consisted of the California Verbal Learning Test (learning 1–5 trials, short delay free recall, long delay free recall), Rey-Osterrieth Complex Figure Test (immediate recall and delayed recall), 3–7 Continuous Performance Test (sensitivity, d'), Verbal and Spatial 2-back Test, Trail-Making Test-Part B, Controlled Oral Words Association Test, Design Fluency Test, Stroop Test and Wisconsin Card Sorting Test. The score from each assessment was converted to a z-score based on the performance of NC subjects. Intellectual functioning (IQ) was also assessed using the K-WAIS (Korean-Wechsler Adult Intelligence Scale; Wechsler, 1981; Kim and Lee, 1995).

Chapman's self-reports of perceptual aberration scale (Chapman et al., 1978) and revised social anhedonia scale (Chapman et al., 1976) were used to assess experiential features of schizotypy (Chapman et al., 1994). The perceptual aberration scale contains 35 true–false items that assess body-image aberration, including unclear boundaries of the body, feeling of unreality of parts of one's body, and perceptions of the change in spatial relationship of one's body parts (Chapman et al., 1978). The revised social anhedonia scale consists of 40 true-