Facial emotion recognition impairment is related to disorganisation in multi-episode schizophrenia

Anna Comparelli a,⁎, Antonella De Carolis b, Valentina Corigliano a, Giada Trovini a, Julia Dehning a, Simone Di Pietro a, Eleonora De Pisa a, Silvana Galderisi c, Paolo Girardi a

a NESMOS Department (Neurosciences, Mental Health and Sense Organs) Unit of Psychiatry, Sant’Andrea Hospital, School of Medicine and Psychology, Sapienza University of Rome, Italy
b NESMOS Department (Neurosciences, Mental Health and Sense Organs) Unit of Neurology, Sant’Andrea Hospital, School of Medicine and Psychology, Sapienza University of Rome, Italy
c Department of Mental and Physical Health and Preventive Medicine, University of Naples SUN, Italy

Abstract

The present investigation explores the relationship between facial emotion recognition (FER) and symptom domains in three groups of schizophrenia spectrum patients (43 ultra-high-risk, 50 first episode and 44 multi-episode patients) in which the existence of FER impairment has already been demonstrated. Regression analysis showed that symptoms and FER impairment are related in multi-episode patients, regardless of the illness duration. We suggest that the link between symptoms and FER impairment is involved in the progression of the disease.

© 2014 The Authors. Published by Elsevier Inc. This is an open access article under the CC BY-NC-ND license (http://creativecommons.org/licenses/by-nc-nd/3.0/).

1. Introduction

In schizophrenia facial emotion recognition (FER) impairment is stable at different stages of the disorder (Comparelli et al., 2013), regardless of the improvement of symptoms over time (Kohler et al., 2000). FER impairment is associated with lower community functioning (Kee et al., 2003), decreased levels of role (Eack et al., 2010), social functioning (Addington et al., 2006), and diminished interpersonal skills (Pinkham and Penn, 2006). As of the relationship with symptoms, we found an association with disorganisation (Comparelli et al., 2014), although associations with positive and negative symptoms (Schneider et al., 1995) were reported as well. One limitation of the literature to date is that it has tended to involve assessments at one point in time, leaving unclear the role that the deficit and its relationship with other aspects of the disease play over time for persons in different phases of illness. Thus, unresolved at present is whether association with core aspects of the disorder such as negative and disorganization symptoms are stable in different phases of illness. Better understanding of this relationship may highlight the predictive role of specific factors on the progression of the illness.

2. Methods

2.1. Subjects

We here reanalysed data from a previous study (Comparelli et al., 2013) in which we found that FER impairment was present before the onset of the full-blown psychosis and was stable across the illness. We enrolled 137 male and female patients over the age of 18 years who were referred either to our Acute Psychiatric Care Department or to our outpatient clinic. Forty-three patients met criteria for psychosis risk syndrome (McGlashan et al., 2010). Ninety-four patients met a diagnosis of DSM-IV schizophrenia or schizophreniform disorder based on the Structured Interview for DSM-IV Disorders-I (SCID-I) (First et al., 1997). Within this group, 50 patients were experiencing their first psychotic episode with very recent onset. Forty-four had an established diagnosis of schizophrenia with multiple-episode history. Exclusion criteria and further details of the patient population have been provided elsewhere (Comparelli et al., 2013). All participants provided informed consent for participation in the study and publication of results. The research was approved by the hospital’s Ethics Committee.

2.2. Psychopathological assessment

Prodromal patients were assessed through the Italian version of the Scale of Prodromal Symptoms (Comparelli et al., 2011a). Psychopathology was rated through the Positive and Negative Syndrome Scale (PANSS)
(Kay et al., 1987). For statistical analysis we used the PANSS factor analysis according to Lykoursa et al. (2000), who extracted the following five factors: a) Positive (P1 delusions, P3 hallucinatory behaviour, P5 grandiosity, P6 suspiciousness, and G9 unusual thought content); b) Negative (N1 blunted affect, N2 emotional withdrawal, N3 poor rapport, N4 passive withdrawal, N6 lack of spontaneity, G7 motor retardation, G16 active social avoidance); c) Excitement (P4 excitement, P7 hostility, G8 uncooperativeness, G14 poor impulse control); d) Anxiety and Depression (G2 anxiety, G3 guilt feelings, G4 tension, G6 depression); e) Disorganisation (N5 difficulty in abstract thinking, N7 stereotyped thinking, P2 conceptual disorganization, G11 poor attention).

The overall level of cognitive functionality was evaluated using the Raven Standard Progressive Matrices (RSPM) (Raven, 2008).

2.4. Statistical analysis

For statistical analysis we used the PANSS factor analysis according to Lykoursa et al. (2000), who extracted the following five factors: a) Positive (P1 delusions, P3 hallucinatory behaviour, P5 grandiosity, P6 suspiciousness, and G9 unusual thought content); b) Negative (N1 blunted affect, N2 emotional withdrawal, N3 poor rapport, N4 passive withdrawal, N6 lack of spontaneity, G7 motor retardation, G16 active social avoidance); c) Excitement (P4 excitement, P7 hostility, G8 uncooperativeness, G14 poor impulse control); d) Anxiety and Depression (G2 anxiety, G3 guilt feelings, G4 tension, G6 depression); e) Disorganisation (N5 difficulty in abstract thinking, N7 stereotyped thinking, P2 conceptual disorganization, G11 poor attention).

To determine associations between symptoms and FER identification and recognition scores, we performed partial correlations correcting for the possible confounding role of the variables that differed among groups. Then, we performed a stepwise regression analysis including all patients. We insert duration of illness and PANSS factors as independent variables and FER scores as dependent variable. Finally, a regression analysis with significant PANSS factor scores as independent variable and FER scores as dependent variable was carried out. A significance level of 0.05 was used for all statistical tests, and two-tailed tests were applied. Tests were carried out with the statistical package SPSS (version 17.0.2).

3. Results

Clinical groups differed for sex, age, duration of illness, IQ and the PANSS positive factor (Table 1). As mentioned in our previous report (Comparelli et al., 2013), the three clinical groups performed worse than healthy control subjects both on the identification and on the recognition tasks. ANCOVA analysis showed no differences between the number of correct answers on both the total scores of subtests A and B between FES and UHR. MES performed significantly worse than UHR on subtest A. Partial correlations (Table 2) adjusting for age, sex and IQ showed that in MES both the identification and the recognition scores correlated negatively with the PANSS positive, negative and disorganisation factor. Correlations retained statistical significance when the illness duration was taken into account. No other significant correlations between PANSS factors and the number of correct answers on the FER tasks were found in MES. In UHR and FES, no significant correlations were found. The stepwise analysis performed on the whole sample with PANSS factors and illness duration as independent variables and FER scores as dependent variables showed that the only unique factor that predicted FER impairment was disorganisation (Subtest A: $B = -0.403; t = -4.225; p < 0.001$; Subtest B: $B = -0.374; t = -4.326; p < 0.001$). When we carried out the regression excluding UHR and FES, PANSS disorganised factor severity explained 42.3% of the variance of the identification test score ($B = -0.495; t = -5.544; p < 0.001$). No other variables entered into the model with statistical significance.

4. Discussion

The purpose of this re-analysis was to determine whether symptoms domains were related to emotion recognition in people affected by schizophrenia.
schizophrenia at different stage of illness. Although there were significant associations between positive, negative and disorganised symptoms, the last symptom domain consistently emerged as the only unique predictor of emotion recognition in people with multi-episode schizophrenia. The lack of association between symptoms, measured with PANSS, and FER performance in the UHR and first-episode groups has also been reported by Amminger et al. (2011). In contrast with our results, Leung et al. (2011) showed the absence of such a relationship even in multi-episode patients. Indeed, Leung et al. (2011) measured only positive and negative symptoms with SAPS and SANS (Andreasen, 1990), whereas our study utilized symptom domains extracted by the PANSS principal component analysis.

Another recent study that explored the relationship between FER performance and PANSS traits found a relationship between disorganised symptoms and FER (Hamm et al., 2012) in a sample of schizophrenia patients with a duration of illness and mean number of episodes comparable to that of our patients. Thus, inconsistencies of results may be due to the use of different symptoms rating scales.

Considering the factor disorganization of the PANSS, the items loading on this factor are the same as those reported by other factorial analyses of the PANSS (Emsley et al., 2003; Lindenmayer et al., 1994; Rodriguez-Jimenez et al., 2013). They are all placed on different sub-scales in the original formulation of the PANSS and comprise one positive (conceptual disorganization), two negative (difficulty in abstract thinking and stereotyped thinking), and one general (poor attention) symptoms. Curiously, despite the growing evidence that cognitive symptoms and disorganisation form the psychopathological core of the illness, specific instruments for this symptoms domain are not available. Rediscovering Bleuler (Bleuler, 1950), the association between disorganisation and facial emotion recognition may constitute the psychopathological core of the illness. According to Bleuler there are two types of symptoms: fundamental and accessory. Fundamental symptoms are essentially disorganised in nature. They were separated into simple fundamental symptoms, including problems in association, affectivity, and ambivalence. These simple fundamental symptoms combined to form compound fundamental symptoms, including disturbances in attention. Attention for Bleuler was rather all encompassing. It included some features that we would call vigilance, but also expanded into areas that we might call social withdrawal. Thus, the disorganisation factor actually resembles fundamental symptoms. The fact that in our study the disorganisation domain and facial emotion recognition impairment are associated only in multi-episode is also consistent with Bleuler’s theory that stated that fundamental symptoms are certainly present in advanced phases of the illness and constitute the hallmark of schizophrenia.

Although the correlative nature of our analyses precludes drawing causal conclusions, our findings suggest some implications for theoretical models of this relationship. Both disorganised symptoms and emotion processing deficits are, in fact, related to worse functional and biological outcomes (Collin et al., 2012; Lysaker et al., 1995). Our results suggest that the linkage between disorganisation and emotional dysfunction may influence or be influenced by the progression of the illness. In the former hypothesis their interaction may play a pathogenetic role, in the latter their relationship could be the final step of unknown mechanisms.

Given the prominence of social impairments in chronic schizophrenia, our research direction can help to identify underlying mechanisms that give rise to social outcome. Unresolved at present is whether formal thought disorders, difficulties in abstract thinking and social cognition represent different aspects of the “deficit schizophrenia” (Gelderisi and Maj, 2009). In this view, one possibility that should be investigated in future studies is that disorganisation and facial emotion recognition reflect a shared aetiology with a possible genetic basis (Fett and Maat, 2011). Rival hypotheses cannot be ruled out, including the possibility of a complex mind/environment interaction in which early social cognition dysfunction, interacting with the external factors, paves the way for a deterioration and a stronger correlation with symptoms (MacBeth et al., 2013). In addition, our findings may have several clinical implications, since examination of underlying commonalities in emotional and thought/cognitive processes could inform treatments jointly aimed at emotional factors and cognitive deficits.

One limitation of our study is that its cross-sectional design does not allow definition of the role of the association between FER impairment and disorganisation in progression of disease. Moreover, we did not rule out a possible role of antipsychotic drugs in emotion recognition. The major strength of our study is that, to our knowledge, it is the first to compare the relationship between emotion processing deficit and symptoms in different groups of schizophrenia patients. As emotion recognition is a fundamental part of social cognition, this study is a step towards better understanding of the link between symptoms and social outcome.

Role of funding source
No funding source to declare.

Contributors
Anna Comparelli designed the study, wrote the protocol, and revised the final draft of the manuscript. Antonella De Carolis undertook the statistical analysis. Valentina Corigliano wrote the first draft of the manuscript. Giada Trovini, Simone Di Pietro and Julia Dehning managed the literature searches and analyses. Eleonora De Pisa, Silvana Galderisi and Paolo Girardi approved the final manuscript.

Conflict of interest
Paolo Girardi has received, in the past, research support from Lilly and Janssen and honoraria from Lilly and Organon and has also participated in Advisory Boards for Lilly, Organon, Pfizer, and Schering.

Acknowledgements
We acknowledge Prof. Roberto Tatarelli for his precious assistance.

References
Addington, J., Saedeh, H., Addington, D., 2006. Facial affect recognition: a mediator between cognitive and social functioning in psychosis? Schizophr Res 85, 142–1508. Amminger, G.P., Schäfer, M.R., Papageorgiou, K., et al., 2011. Emotion recognition in individuals at clinical high-risk for schizophrenia. Schizophr Bull 38, 1030–1039. Andreasen, N.C., 1990. Methods for assessing positive and negative symptoms. Mod Prog Pharmacopsychiatry 24, 73–88. Bleuler, E., 1950. Dementia praecox or the group of schizophrenias. International Universities Press, New York, N.Y.
Collin, G., Deeks, E.M., Van Haren, N.E., et al., 2012. Symptom dimensions are associated with progressive brain volume changes in schizophrenia. Schizophr Res 138, 171–176. Comparelli, A., Savoja, V., Kotzalidis, G.D., et al., 2011a. Factor-structure of the Italian version of the scale of prodromal symptoms (SOPS): a comparison with the English version. Epidemiol Psychiatr Sci 20, 42–54. Comparelli, A., De Carolis, A., Corigliano, V., et al., 2011b. Subjective disturbance of perception is related to facial affect recognition in schizophrenia. J Nerv Ment Dis 199, 802–806.

Table 2
Partial correlation between PANSS factors and corrected answer on emotion recognition tasks in UHR, FES and MES (first line UHR group; second line FES group; third line MES group).

|          | PANSS POS | PANSS NEG | PANSS EXC | PANSS DEP | PANSS DIS |
|----------|-----------|-----------|-----------|-----------|-----------|
| Identification | 0.373 | -0.034 | 0.325 | -0.085 | -0.031 |
|          | 0.074 | 0.199 | -0.057 | 0.192 | 0.099 |
|          | -0.410 | -0.347 | -0.375 | 0.085 | -0.833** |
| Recognition | 0.164 | -0.215 | 0.359 | 0.055 | 0.116 |
|          | 0.002 | -0.034 | -0.084 | 0.004 | -0.296 |
|          | -0.543* | -0.575* | -0.122 | -0.191 | -0.571* |

*p < 0.05; **p < 0.001.

PANSS POS: positive factor; PANSS NEG: negative factor; PANSS EXC: excitement factor; PANSS DEP: depressive factor; PANSS DIS: disorganized factor.
Comparelli, A., De Carolis, A., Corigliano, V., et al., 2012. Neurocognition, psychopathology, and subjective disturbances in schizophrenia: a comparison between short-term and remitted patients. Compr Psychiatry 53, 931–939.

Comparelli, A., Corigliano, V., De Carolis, A., et al., 2013. Emotion recognition impairment is present early and is stable throughout the course of schizophrenia. Schizophr Res 143, 65–69.

Comparelli, A., De Carolis, A., Corigliano, V., et al., 2014. Symptom correlates of facial emotion recognition impairment in schizophrenia. Psychopathology 47 (1), 65–70.

http://dx.doi.org/10.1159/000350453.

Eack, S.M., Greeno, C.G., Pogue-Geile, M.F., et al., 2010. Assessing social-cognitive deficits in schizophrenia with the Mayer-Salovey-Caruso emotional intelligence test. Schizophr Bull 36, 370–380.

Ekman, P., Friesen, W.V., 1975. Unmasking the face. Englewood Cliffs, Spectrum-Prentice Hall, New Jersey.

Emsley, R., Rabinowitz, J., Torreman, M., et al., 2003. The factor structure for the Positive and Negative Syndrome Scale (PANSS) in recent-onset psychosis. Schizophr Res 61, 47–57.

Fett, A.K., Maat, A., 2011. GROUP investigators. Social cognitive impairments and psychotic symptoms: what is the nature of their association? Schizophr Bull 39, 77–85.

First, M.B., Spitzer, R.L., Gibbon, M., et al., 1997. Structured clinical interview for DSM-IV axis I disorders SCID-I: clinician version. American Psychiatric Press, Washington, DC.

Galderisi, S., Maj, M., 2009. Deficit schizophrenia: An overview of clinical, biological and treatment aspects. Eur Psychiatry 24, 493–500.

Ham, J.A., Renard, S.B., Fogley, R.L., et al., 2012. Metacognition and social cognition in schizophrenia: stability and relationship to concurrent and prospective symptom assessments. J Clin Psychol 68, 1303–1312.

Kay, S.R., Fiszbein, A., Opler, L.A., 1987. The Positive and Negative Syndrome Scale (PANSS) for schizophrenia. Schizophr Bull 13, 261–276.

Kee, K.S., Green, M.F., Mintz, J., et al., 2003. Is emotion processing a predictor of functional outcome in schizophrenia? Schizophr Bull 29, 487–497.

Kohler, C.G., Bilker, W., Hagendoorn, M., et al., 2000. Emotion recognition deficit in schizophrenia: association with symptomatology and cognition. Biol Psychiatry 48, 127–136.

Leung, J.S., Lee, T.M., Lee, C.C., 2011. Facial emotion recognition in Chinese with schizophrenia at early and chronic stages of illness. Psychiatry Res 190, 172–176.

Lindenmayer, J.P., Bernstein-Hyman, R., Grochowski, S., 1994. A new five factor model of schizophrenia. Psychiatr Q 65, 299–322.

Lykouras, L., Oulis, P., Psarras, K., et al., 2000. Five-factor model of schizophrenic pathology: how valid is it? Eur Arch Psychiatry Clin Neurosci 250, 93–100.

Lysaker, P.H., Bell, M.D., Bioty, S.M., 1995. Cognitive deficits in schizophrenia. Prediction of symptom change for participants in a work rehabilitation. J Nerv Ment Dis 183, 332–336.

MacBeth, A., Gumley, A., Schwannauer, M., et al., 2013. Metacognition, symptoms and premorbid functioning in a First Episode Psychosis sample. Compr Psychiatry 55, 268–273.

McGlashan, T., Walsh, B., Woods, S., 2010. The psychosis-risk syndrome. Handbook for diagnosis and follow-up. Oxford University Press, New York.

Pinkham, A.E., Penn, D.L., 2006. Neurocognitive and social cognitive predictors of interpersonal skill in schizophrenia. Psychiatry Res 143, 167–178.

Raven, J.C., 2008. SPM standard progressive matrices. Matrici progressive di raven. Serie A, B,C,D,E (Italian translation). Giunti OS, Firenze.

Rodriguez-Jimenez, R., Bagney, A., Mezquita, L., et al., 2013. Cognition and the five-factor model of the positive and negative syndrome scale in schizophrenia. Schizophr Res 143, 77–83.

Schneider, F., Gur, R.C., Gur, R.E., et al., 1995. Emotional processing in schizophrenia: neurobehavioral probes in relation to psychopathology. Schizophr Res 17, 67–75.