Schizophrenia Research 115 (2009) 278–285

Contents lists available at ScienceDirect

Schizophrenia Research

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

'Theory' of mind impairment in patients affected by schizophrenia and in their parents

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ARTICLE INFO

Article history:
Received 23 July 2009
Received in revised form 9 September 2009
Accepted 16 September 2009
Available online 8 October 2009

Keywords:
Schizophrenia
'Theory' of mind
Parents
Cognitive functioning

ABSTRACT

"Theory of mind" (ToM) is the ability to judge the mental states of the self and others. It is currently considered as a part of the broader concept of social cognition, known to influence the social behaviour of patients affected by schizophrenia. Recently it has been hypothesized that the impairment of ToM is a trait that can be detected both in patients with schizophrenia and in non-psychotic relatives of patients, but it still not clear what the contribution of the familial patterns of cognitive impairment is.

The aim of this study is to assess parental impairments of ToM performance considering the effects of the neurocognitive abilities known to be impaired in their first-degree relatives and to influence ToM in schizophrenic patients.

Patients, their parents and control trios were assessed with the Wisconsin Card Sorting Test (WCST), the Symbol Coding Task and the ToM Picture Sequencing Task. The ANCOVA analysis on 47 trios including a schizophrenic offspring and 47 healthy trios showed a statistically significant poorer performance of patients and their parents in comparison to control trios at Symbol Coding Task and ToM task. Moreover a regression analysis showed that the neuropsychological abilities tested were significant predictors of ToM performance only in patients. Results confirm a ToM impairment among parents of patients with schizophrenia that is not directly correlated to other aspects of neurocognitive functioning.

1. Introduction

Difficulties in several skills regarding domains of social functioning, such as communication, interpersonal relationships, family and occupational roles are typical in patients with schizophrenia (Priebe, 2007). Theoretical models have been elaborated relying on a cognitive perspective that distinguishes between "social cognition" — a domain of cognition that involves the perception, interpretation, and processing of social information (Adolphs, 1999), "social competence" – assessed in laboratory context – and "social behaviour" in the real-world (Bellack et al., 1994). Global neuropsychological efficiency was shown to be significantly related to performance in many real-world functional domains including social behaviour, with significant relationships between specific cognitive and functional domains (Green et al., 2000; Bowie and Harvey, 2008). Recently, Bowie and Harvey (2008) showed that cognitive abilities are relevant both for the acquisition of social or living skills and for the deployment of these skills in the real-world. In that study, effects of cognitive performance were significantly related, both directly and indirectly, to social behaviour

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doi:10.1016/j.schres.2009.09.018

components. Among these, interpersonal behaviour was directly predicted by processing speed and executive functions, and indirectly predicted by attention and working memory capacities through the mediating effect of social competence. These last findings supported the hypothesis that performance underlying social cognition might be a mediator between neurocognitive functioning and social outcomes in the real-world (Green et al., 2000).

Given their role in the development of correct social cognition skills, it is noticeable that most of the above cited neuropsychological abilities involved in social cognition were also consistently impaired in unaffected first-degree relatives.

Familial studies regarding neuropsychological performance found a significant impairment in first-degree relatives' performance, affecting the majority of cognitive domains (Roxborough et al., 1993; Laurent et al, 2002; Keefe et al., 1994, for a meta-analysis, Snitz et al., 2006). In some studies the degree of impairment in the unaffected relatives was shown to be intermediate compared to patients and healthy controls (Kremen et al., 1994; Keefe et al., 1994; Egan et al., 2001).

However, results of single studies are still contradictory, probably because they differ both in the degree of relatives included (sibling, parents or offspring) and in the tasks assessed. Most studies included unspecified first-degree relatives (mainly siblings and parents) and showed an impairment on the part of first-degree relatives in sustained attention (Kremen et al., 1994; Chen et al., 1998), verbal and working memory (Conklin et al., 2000, 2005), verbal fluency (Laurent et al., 2002) and executive function (Krabbendam et al., 2001; Toulopoulou et al., 2003). More recently Bove (2008) confirmed that relatives presented only a slightly worse cognitive performance than controls, manifesting lower scores especially in the tasks requiring a greater cognitive processing load. Some other studies included only siblings, in order to reduce the confounding effect of age and found an impairment in non-affected siblings in all measures of functioning, especially verbal memory, abstraction and attention (Franke et al., 1994; Cannon et al., 1994), cognitive flexibility (Egan et al., 2001) and verbal fluency (Hughes et al., 2005). Niendam et al. (2003) reported that children who later developed schizophrenia and their siblings showed similar patterns of deficits involving spatial reasoning, verbal knowledge, perceptual-motor speed and working memory.

Few studies focused specifically on parents of patients with schizophrenia. In a review Docherty (1994) provided substantial evidence that non-affected parents of patients with schizophrenia show subtle cognitive difficulties in the area of concept formation and maintenance. Harris et al. (1996) demonstrated that neuropsychological dysfunctions in attention and learning were found only in a subgroup of parents of patients with a family history of schizophrenia. Dollfus et al. (2002) found a significant impairment in parents of patients with schizophrenia in a verbal fluency task. In Appels et al. (2003) study, parents of schizophrenic patients were more impaired than healthy control couples on global verbal memory, motor skills, sustained attention and verbal fluency.

Nevertheless, social behaviour itself involves the integration of different skills such as Theory of mind, perception of social signs, recognition of facial expressions, attention, memory, decision making processes and motivation. Most of these components of social cognition were found to be impaired in patients with schizophrenia, in particular "Theory of mind" (ToM) (Frith and Corcoran, 1996), the ability to judge the mental states of the self and others.

Impairments in the performance of a number of social cognition and social competence tests have been suggested in the literature also in relatives of patients with schizophrenia (Toomey et al., 1999; Mirsky et al., 1992), but no studies have evaluated their influence on social behaviour in the real life. Toomey et al. (1999) found that relatives of patients with schizophrenia were deficient in the social perception of non-verbal cues when compared to healthy controls. First-degree relatives showed memory impairment in recognition of faces (Conklin et al., 2002) and in visual scan paths of emotional faces (Loughland et al., 2004). Previous research demonstrates that relatives display measurable deficits also in pragmatic aspects of expressive language (Mazza et al., 2008) as well as in their ability to verbalize emotions (Marjoram et al., 2006). Other studies have used the Eyes Test (Baron-Cohen et al., 2001) – designed to measure affective ToM – with inconsistent results: Irani et al. (2006) found that relatives of patients with schizophrenia showed an intermediate performance between patients and healthy controls, while Kelemen et al. (2004) did not find any differences on the Eyes Test measure between relatives of patients with schizophrenia and healthy controls. Janssen et al. (2003) showed a significant 'relatedness–response' relationship in the association between schizophrenia and errors on the Hinting Task, specifically assessing the Theory of mind (Corcoran et al., 1995), with patients having the highest probability of bad performance, and first-degree relatives having intermediate values.

On the other hand, some issues regarding the significance and the nature of these last results on first-degree relatives regarding social cognition and theory of the mind in particular have not been sufficiently addressed yet.

The first point is that – while for patients impaired performance on testing is related to failures in social cognition performance in real life (Brune, 2005; Bora et al., 2006) – the same kind of failure has not been studied among their unaffected relatives, who in most cases are within the normal range.

Second, the findings that neuropsychological performance may be an intermediate phenotype limits the interpretation of social cognition data in that cognitive impairments are correlated with social cognition performance (at least in the laboratory) in patients with schizophrenia. Subsequently, the impairments in social cognition might also be influenced by neuropsychological performance impairments for parents, possibly influencing the abilities tested. In fact, it is still a matter of debate if performance on ToM tasks is an independent function or whether it reflects a dysfunction of other cognitive abilities such as attention, memory and general intelligence. Some authors argued that the ToM deficits in schizophrenia are part of a generalized intellectual decline (Brune, 2003), but there is evidence that deficits in the Theory of mind in schizophrenia cannot be explained by the effect of lower IQ alone (Mazza et al., 2001). However, recent studies found that ToM performance impairment was related to executive functions (Brune, 2005), verbal memory (Greig