Emotional processing in schizophrenia: Neurobehavioral probes in relation to psychopathology

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Abstract

The application of neurobehavioral methods in functional neuroimaging can provide useful information on the neurobiology of schizophrenia. This process can be enhanced by using a standard set of procedures to construct 'neurobehavioral probes' which are suitable for functional imaging and provide reliable measures discriminating patients from healthy controls. While such probes are available for cognitive tasks, none has been applied to study emotional processing in schizophrenia. We examined emotional discrimination and experience probes and correlated performance with cognitive and clinical measures. Emotion discrimination tasks and mood induction procedures with happy, sad, and neutral facial expressions were administered to 40 patients with schizophrenia. Neuropsychological testing assessed intellectual, attention, abstraction-flexibility, memory, language, spatial, and sensory-motor functions. Emotional performance was compared to a group of 40 normal subjects. Performance for face discrimination was impaired in patients. There was specific impairment in discrimination of happy expressions. Mood induction was effective in both groups, but diminished in patients, especially for happiness. Poorer performance in emotion discrimination correlated with severity of negative symptoms and bizarre behavior. Hallucinations were associated with more pronounced mood induction effects. Emotion discrimination was also correlated with abstraction, memory, language and spatial tasks, while mood induction effects showed no such associations. Thus, the impairment in discriminating and experiencing valence-specific emotions in schizophrenia relates to symptomatology and neuropsychological functioning. The results encourage the use of the emotion discrimination task and the mood induction procedure as neurobehavioral probes in physiologic neuroimaging studies for investigating the neural substrates of emotion.

Keywords: Mood induction; Emotion discrimination; Neurobehavioral probe; (Schizophrenia)

1. Introduction

Advances in neurosciences have opened up novel inroads for investigating neural substrates of cognitive and emotional behavior. The application of neurobehavioral probes in physiologic neuroimaging studies is an avenue for examining links

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between regional brain function and behavior (Gur et al., 1992). The process of implementing such probes requires several steps. These include identifying a unitary behavioral dimension, selecting or developing tasks which measure this dimension, and are suitable for use with physiologic neuroimaging methods, demonstrating the reliability and validity of the measures in a normative sample, and examining the relationship between the behavioral measures and clinical features of patients.

Such probes have been described in schizophrenia for cognitive tasks (e.g., Gur et al., 1983, 1985; Weinberger et al., 1986), but none have examined emotional processing.

Impairments in emotional behavior have been observed in schizophrenia, including lack of relatedness and inappropriate and blunted affect. In contrast to cognitive abilities, where the criteria are quantifiable, emotional behavior is difficult to measure psychometrically and measures of experiential aspects have to rely on subjective judgment. Those concerns may explain why research on emotional processing has lagged behind cognitive studies. Recently, however, advances in psychology of emotions (Clark, 1992) have provided tools to measure individual differences in the ability to recognize, experience, and express valence specific emotion.

Several studies reported impaired emotional processing in schizophrenia, primarily in discrimination relative to control tasks (age discrimination, facial identity; Feinberg et al., 1986; Mandal and Gewali, 1989; Walker et al., 1984; Heimberg et al., 1992; Schneider et al., 1992a). Few analyzed relationship to psychopathology, and reported either no relation with performance (Muzekari and Bates, 1977; Novic et al., 1984) or an association with the severity of symptoms specific to schizophrenia (Heimberg et al., 1992). Clinically, the expression and experience of emotion seem as important as discrimination ability (Schneider et al., 1992b), but this received even less scrutiny. It would seem particularly essential to examine how discrimination and experience are interrelated in the context of cognitive impairment and clinical features.

This study attempts to integrate a neurobehavioral probe designed to activate emotional discrimination and experiential processes in the study of affect impairment in schizophrenia. In earlier studies, we have described and standardized tests for emotion discrimination (Erwin et al., 1992) and mood induction (Schneider et al., 1994a) in healthy subjects. We then studied healthy subjects in neuroimaging studies with [133]Xenon (Gur et al., 1994; Schneider et al., 1994b) and PET [15]Oxygen for measuring CBF (Schneider et al., 1995) The results encourage the application of the emotion discrimination task to schizophrenia (Heimberg et al., 1992). The purpose of the present study was to examine these emotion discrimination and mood induction tasks in a new and larger sample of patients and controls, relating performance on the emotional tasks to cognitive measures and psychopathology. Such correlational data are helpful for designing future activation studies testing hypotheses on the relation between regional brain activation and behavior.

2. Methods

2.1. Subjects

Forty patients (19 women, 21 men) who met DSM-III-R criteria for schizophrenia were recruited and assessed by the MHCRC using procedures described earlier (Gur et al., 1991). These patients had a relatively short treatment history. There was no overlap with the subjects described in our earlier studies on emotion discrimination (Heimberg et al., 1992; Erwin et al., 1992).

Mean age and education were 30.4 ± 7.7 and 12.8 ± 1.9 years. Age of onset was 24.25 ± 7.79 ($\pm SD$), median of previous hospitalizations 1, and the majority was evaluated in an ambulatory setting when clinically stable (only 8 were inpatients at time of assessment). Subtypes included chronic undifferentiated ($n = 11$), paranoid ($n = 23$), disorganized ($n = 5$), and catatonic ($n = 1$). Seventeen were medication-free from 3 weeks to lifetime, 23 received a median of 180 mg Chlorpromazine equivalents (range: 40–760).

Symptom ratings included the Brief Psychiatric Rating Scale (BPRS; Overall and Gorham, 1962), the Scale for Assessment of Negative Symptoms (SANS; Andreasen, 1982), and the Scale for the Assessment of Positive Symptoms (SAPS; Andreasen, 1984). BPRS ranged 18–65 (37.5 ± 12.1). Global ratings for SANS were, Affective Flattening (AFF), 1.8 ± 1.5; Alogia (ALO), 1.3 ± 1.5; Avolition-Apathy (APA), 1.7 ± 1.5; Anhedonia-Asociality (ANH), 2.8 ± 1.3; Attention (ATT), 0.8 ± 1.3; SAPS, Hallucinations (HAL), 1.5 ± 1.6; Delusions (DEL), 2.2 ± 1.8; Bizarre Behavior (BIZ), 0.7 ± 1.1; Positive