Recognising Emotional Disturbances in schizophrenia Patients

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Abstract- *Schizophrenic patients are known to experience difficulties in emotional information processing, yet knowledge of their physiological responsivity to emotional stimuli is limited. The purpose of this study was to investigate the physiological reactions of schizophrenic patients to emotional stimuli. We presented pictures selected from the International Affective Picture System (IAPS) to patients and controls, while assessing their subjective evaluations in terms of valence and arousal scores and measuring their responses of heart rate (HR), breathing rate (BR), skin conductance level (SCL) and diastolic (DBP) and systolic blood pressure (SBP). For the analysis of the physiological data, three emotional picture categories were formed: positive (erotic content), negative (physical injuries) and neutral (landscapes). Patients and controls did not differ in their subjective evaluations of the pictures. Also, for both patients and controls, the SCL and DBP responses to positive emotional pictures were larger as compared to negative and neutral pictures. However, the patients did show significantly increased HR responses to the positive emotional pictures as com- pared to controls, possibly as a result of a decreased parasympathetic activity. Only for the BR response to the positive emotional pictures did we observe significant positive correlations with the PANSS scores.*

I. INTRODUCTION

Over the past decade the emotional disturbances schizophrenic patients experience have received increasing attention (Edwards et al., 2001). Schizophrenic patients appear to have an impairment in recognising faces and emotional facial expressions (Addington and Addington, 1998; Kohler et al., 2003), as well as an impairment in identifying affective prosody (Edwards et al., 2001). Baudouin et al. (2002) found that the emotion processing deficit schizophrenic patients experience was related to negative symptoms and that the inability to selectively attend to emotion was correlated with the severity of the negative symptoms, although Kohler et al. (2000) found a positive correlation between emotion recognition and both negative and positive symptomatology.

Lang et al. (1998) have postulated the existence of two motivational systems in the brain, i.e., appetitive (positive emotions) and defensive (negative emotions), that each can vary in terms of activation or arousal. Arousal here is not viewed as having a separate substrate, but rather as representing the intensity of activation of either the appetitive or the aversive system or the coactivation of both systems, which may be reflected in physiological processes. Although research investigating the emotional disturbances in schizophrenic patients has thus far mainly focused on the recognition of faces and facial expressions, it is also relevant to investigate the emotional disturbances that schizophrenic patients experience daily in their environment in relation to their physiological responsivity. For this purpose, pictures of affective events and objects can be used. Emotional pictures are ecologically valid stimuli in the sense that they involve processing of the kinds of visual material that people encounter frequently in their daily lives (Bradley and Lang, 1999). Furthermore, the validity of emotional pictures in investigating emotional processing and brain activity has been demonstrated by several neuroimaging studies in which pictures with emotional content, selected from the International Affective Picture System (IAPS; Center for the Study of Emotion and Attention, 1997), were presented to subjects (Hariri et al., 2002, 2003; Moratti et al., 2004; Muller et al., 2003; Phan et al., 2004).

The purpose of this study was to investigate the physiological reactions of schizophrenic patients to pictures with emotional content. During the presentation of pictures selected from the IAPS (Center for the Study of Emotion and Attention, 1997), HR, SCL, breathing rate (BR), and diastolic and systolic blood pressure (DBP, SBP) were measured in order to identify alterations in responsivity to emotional stimuli of schizophrenic patients as compared to normal controls. Additionally, we assessed their subjective evaluations of the pictures in terms of valence and arousal ratings. Because scenes of threat, violent death and erotica cause the strongest emotional arousal and the largest physiological responses (Bradley et al., 2001), we focused on pictures depicting erotica (positive emotions), mutilations and burns (negative emotions), and landscapes (neutral).

II. METHODS

2.1. Subjects

The psychiatric diagnoses were performed by a senior psychiatrist; patients were eligible if they had the diagnosis schizophrenic or schizophreniform disorder according to the criteria of the DSM-IV (APA, 1994). Patients suffered from the paranoid (n = 16), disorganised (n = 7), undifferentiated (n =2) and residual (n = 1) types of schizophrenia, and two patients were diagnosed as having a schizophreniform disorder. All patients experienced a psychotic episode at the time of the study.

Controls were recruited by means of advertisements. All controls were healthy and drug-free at the time of testing as assessed by means of an interview and a questionnaire. None of the controls had experienced past or current psychiatric illnesses.

After the subjects were given a complete description of the study, written informed consent was obtained. The study was approved by the Medical Ethical Committee of the Erasmus MC Rotterdam.

2.2. Procedure

In order to assess the clinical severity of the psychiatric symptoms for the schizophrenic patients, the PANSS interview was performed by a senior psychiatrist before the experimental measurement of the schizophrenic patient. The three subscales of the PANSS (positive symptoms, negative symptoms and general psychopathology) as well as the Total score of the PANSS were used for the analyses of potential relationships between clinical symptom severity and physiological responsivity to emotional stimuli.

2.3. Physiological measures

With this method, a finger cuff containing photoelectronic components for measuring a blood plethysmograph and a bladder for applying pressure to the finger, is wrapped around the subject's finger of the non-dominant hand, and continuous arterial pres- sure is measured non-invasively. It was made sure that the non-dominant hand was located at the heart level in order to obtain reliable BP data. Respiration was measured using an inductive plethysmography method.

All data were sampled and stored on a flashcard by means of a portable digital recorder after completion of the recording, all physiological data were imported and processed on a Personal Computer using a Vitagraph software module.

2.4. Statistical analysis

A Time (t1–t13) by Picture (positive, negative and neutral) by Group (patient and control) mixed model analysis of variance (ANOVA for repeated measures) was used for each of the five physiological signals to examine the effects of Time, Picture type and Group. We defined Group as the between subjects factor, and Time and Picture as the within subjects factors. Because of the non-linear responses that were found for the physiological signals, the relationship with Time was modelled as a third order function by including in the model time, time squared and cubic time. The within- subject serial correlation of the responses was assumed to have a first order autoregressive structure.

Within both groups, differences in the SAM ratings for pleasure and arousal between the three picture categories were analysed using the non-parametric Friedman test. To test the differences in pleasure and arousal ratings between the patient and the control group, non-parametric Mann–Whitney U tests were performed.

Mean baseline values (SD) of the physiological parameters for the control group and patient group

	Mean (SD)	
	Controls (n = 30)	Patients (n = 28)
SCL (μS)	9.03 (4.9)	7.59 (4.8)
HR (bpm)[a]	66.9 (8.5)	77.2 (11.9)
BR (breaths/m)[a]	13.9 (2.8)	16.0 (3.2)
DBP (mm Hg)	85.6 (13.4)	82.5 (19.3)
SBP (mm Hg)	140.4 (23.1)	137.0 (16.8)

SCL: skin conductance level; HR: heart rate; BR: breathing rate; DBP: diastolic blood pressure; SBP: systolic blood pressure.
[a] Significant difference between groups, $p < 0.01$.

Table 1

All statistical analyses were two-tailed, and the α was defined as 0.05. We used the Statistical Packages for the Social Sciences (SPSS) version 10.1 (SPSS Inc., 2000) and SAS 6.12 (SAS Institute, Inc., 1996) to analyse our data.

III. RESULTS

3.1. Baselines

In Table 1, the results are shown for the baselines of each of the five physiological signals. The patients showed a significantly higher mean HR ($t = -3.73$, $p < 0.01$) and a significantly higher mean BR ($t = -2.71$, $p < 0.01$) than controls.

3.2. Skin conductance level

A significant Time effect was found ($F= 6.80, p < 0.05$), indicating that the SCL responses of the subjects

changed significantly in time from picture onset to the end of the picture presentation (Fig. 1). Furthermore, a significant interaction effect was found for Time by Picture ($F= 3.83$, $p < 0.05$): in both the patient and the control group, the different emotional categories of pictures resulted in different response curves. Both groups showed a largest response to the positive pictures as com- pared to the neutral and negative pictures (Fig.1).

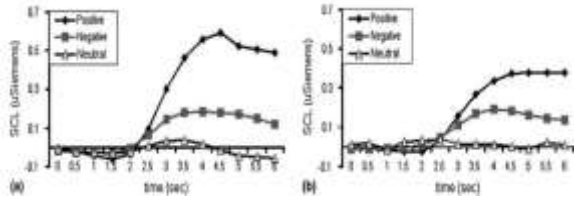

Fig. 1. Mean SCL response (μS) to positive, negative and neutral pictures during a 6-s picture presentation period: (a) controls and (b) patients.

3.3. Heart rate

A significant Time effect was found ($F= 4.46$,$p < 0.05$), indicating that the HR responses of the subjects changed significantly during the 6-s picture presentation. Also, significant interaction effects were found for Time by Group ($F= 4.79$, $p < 0.05$) and for Picture by Group ($F= 5.12$, $p < 0.05$), indicating that the patient group showed a significantly different HR response in time as compared to the control group, regardless of picture valence, and that the patients also showed significantly different HR levels to the emotional pictures pictures as compared to the control group. While viewing the positive pictures, the patients showed a gradual increase followed by a decrease in HR response, whereas the control subjects showed a biphasic response.

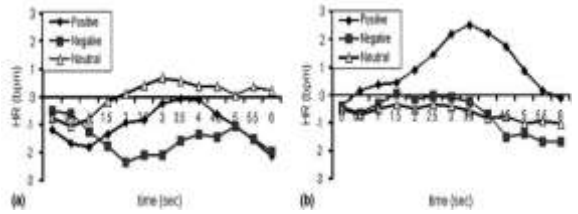

Fig. 2. Mean HR response (bpm) to positive, negative and neutral pictures during a 6-s picture presentation period: (a) controls and (b) patients.

3.4. Breathing rate

For BR, no significant differences were found in response patterns either between or within the subject groups (Fig. 3).

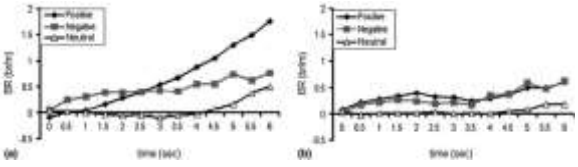

Fig. 3. Mean BR response (br/m) to positive, negative and neutral pictures during a 6-s picture presentation period: (a) controls and (b) Patients.

IV. DISCUSSION

To our knowledge, this is the first study to evaluate physiological reactions to emotional pictures in schizophrenic patients. We found that the control group and the patient group showed significantly different HR responses to the emotional pictures. Although we did not find a significant Time · Group · Picture interaction, we did find a significant Time · Group interaction. As can be seen in Fig. 2, the responses to the positive emotional pictures are likely to contribute the most to this interaction effect. The control group showed an overall modest decrease in HR, first a deceleration, followed by only a slight acceleration.

The schizophrenic patients showed an initial acceleration when viewing the emotional pictures, which could imply a deficit in their ability to direct their attention to the emotional stimulus (deficit in orienting). Thus, from our re- sults it is not clear whether the patients had difficulty in orienting to the erotic pictures, or whether the erotic stimuli were experienced as highly emotional by the schizophrenic patients.

We found that only the positive pictures differentiated between the control and the patient group for the physiological responses. In this study, we presented erotic pictures as positive stimuli. It is possible that the specific nature of these erotic pictures led to the different physiological response pattern of the patient group. For example, the physiological reactions of the control and the patient group may be the result of feelings other than ‘pleasure’, such as shame or discomfort when watching the erotic pictures, resulting in a greater arousal as compared to the pictures showing mutilations and landscapes

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