Schizophrenia and the Potentiation of the Postauricular Reflex: A Study on Emotion

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KEYWORDS. Schizophrenia, postauricular reflex, emotion

BRIEF. This study focused on the emotional perception of schizophrenic patients, using a biological method.

ABSTRACT. This study aimed to understand emotion processing in patients with schizophrenia. Schizophrenia is a psychotic disorder that affects about 1% of the population and can distort the way patients feel, understand and express. Moreover, because of the nature of psychosis, patients' self reports about their emotional experiences may not be accurate. Therefore, nonverbal, psychophysiological indexes of emotional processes were employed. The postauricular reflex (PAR) is elicited by a small muscle behind the ear that flexes to a greater extent when positive emotions (e.g., happiness) are experienced, compared with neutral or negative emotions. For negative emotions, the startle reflex was measured from the muscle below the eye. Patients with schizophrenia and healthy participants were shown standardized pictures that have been shown to elicit pleasant, neutral, and aversive emotional states. PAR and startle reflex were measured for each picture with sensors and compared to other psychological measurements including self-reports. Schizophrenic patients showed stymied responses to both positive and negative images. These results suggest that biologically, emotional responses in schizophrenic patients are stymied compared with those in healthy people. Such reduced range of emotional experience could lead to impairments in social interactions.

INTRODUCTION.

Physically measuring states of emotion has long been an essential issue in psychology. Emotion has been difficult to quantify, but body reflexes and reactions have been observed as responses to emotional stimulus [1]. Human understanding in the area of these affective disturbances has remained superficial. These disturbances are associated with the social dysfunction of the psychotic and psychosis-prone portion of the human population. Disturbances in emotional processing are serious symptoms of widespread disorders such as schizophrenia and depression. Due to the gravity and prevalence of these disorders, understanding this issue is of great importance.

Schizophrenia is a particular area of psychosis in which patients have issues discerning and associating emotionally. Emotional processing can be a key way of defining schizophrenia. A specific category of patients is defined as having negative symptoms, of which flat affect is one [2]. This symptom disturbs patient's social interactions by disabling their outward expression of emotion [3].

Using postauricular reflex (PAR) to examine emotional processing in schizophrenic patients could be a window into defining anhedonia. Anhedonia is a psychological feature that occurs in many types of psychosis, and is usually defined as a defect in capacity to feel pleasure [4]. It is characterized by lack of pleasure at external events, and no joy or exuberant happiness [4]. Whether this pleasure is experienced when something is being consumed, used, or experienced, versus the pleasure of looking forward to or the idea of something is heavily debated in the psychological community. Understanding which aspect of pleasure anhedonia relates to could greatly assist in understanding the nature of emotional processing in psychosis.

Until recently, physical measurement of emotion dealt with aversive emotional processing: the startle blink reflex [5, 6]. The startle blink reflex is the defensive physiological reaction that humans have to startling and alarming events: simply put, blinking [5, 6]. Instead of solely using a method that assesses negative emotion, PAR was used in this study. PAR has been observed to be a direct measure of positive emotion [1]. The PAR reflex is an instinctive muscle response in humans that acts to pull the ear up and back. In a study using pictures, PAR has been observed to be larger when a startle probe is presented during positive pictures than during neutral pictures, and be considerably smaller during aversive pictures [5]. PAR has never been looked at in a schizophrenic population: this study is the first to use it to look at emotion in this particular form of psychosis. By looking at biological responses to emotional stimuli it can be better directly determined how a patient is actually reacting emotionally to their environment.

MATERIALS AND METHODS.

Subjects.

A total of 18 outpatients with schizophrenia (SZ) were recruited from private psychiatric facilities in Nashville, Tennessee. Healthy control participants (HC; n = 11) were recruited through the online SONA psychology research signup site (http://vanderbilt.sona-systems.com/). Healthy participants were also recruited from the community. Participants were matched for age, sex, IQ, and years of education.

Some data was excluded from this study due to technical difficulties such as malfunctioning electrodes and poor impedances. The latter interferes with the conductive ability of the sensors and their measurement of minute biological details. As a result, data generated from sensors with poor impedances are unreliable and must be excluded. Three SZ patients and one HC participant were excluded on account of these criteria, leaving a total of 15 SZ and 10 HC participants in the analyses.

Informed written consent was obtained from each participant and each was compensated for their participation. The Vanderbilt University Institutional Review Board (IRB) approved all procedures.

Psychophysiological Measures.

Psychophysiological measures were taken via electromyography (EMG) and electroencephalography (EEG). Skin was scrubbed with NuPrep microabrasive gel and then the electrodes were set up, using conductive gel. A total of fourteen hanging sensors were applied to different areas on the scalp, behind the ears and below the eyes. An EEG sensor cap was used for the scalp electrodes. For measurement of the PAR, electrodes were placed behind the pinna, one directly on the ear and the other on the side of the head [5, see Figure 1]. The startle blink reflex (ORB) was measured by electrodes placed on the orbicularis muscle underneath the pupil, directly below the eye.

Figure 1. PAR electrode setup.

Paradigm.

The participants were asked to view a series of images from the International Affective Picture System (IAPS). IAPS pictures were of either a positive, negative, or neutral valence. Positive images consisted of adventure (extreme sports), romantic/erotic scenes, food, or nurturance; whereas negative images were threatening or violent. Images with neutral valence consisted of mundane things such as utensils or buildings. The image valences were determined from previous ratings by healthy volunteers.

The IAPS images were presented to the participant. After viewing an image, he or she was asked to rate it for how pleasant the image made the participant feel on a scale of 1 (very much so) to 9 (very little). The participant was also asked to rate how excited the image made them feel on a scale of 1 (very much so) to 9 (very little). A white noise probe (a startling non-identifiable sound) was emitted during the showing of each image to elicit the startle reflex and the PAR.

Data analysis.

EEG and EMG data were processed through Neuroscan Edit 4.5. The data was processed through Matlab using scripts written by Dr. Benning, and then analyzed via SPSS and JMP. The data was aggregated to a quantifiable form from Neuroscan using Matlab. It was then analyzed in JMP and SPSS, with multivariate analysis to identify correlations. Analysis of variance (ANOVA) was used to quantify the extent of these correlations.

RESULTS.

Both HC and SZ groups rated image valence and arousal. There were no significant group differences between the average image ratings for both valence and arousal. A significant difference ($F_{(1,24)} = 8.3436$, $p=0.0083$) existed in the PAR potentiation during pleasant vs. neutral images: healthy controls potentiated significantly higher than schizophrenic patients (see Figure 2A). Conversely, the startle-blink reflex showed significantly greater potentiation during negative vs. neutral images for HC participants than SZ patients ($F_{(1,24)}=4.4643$, $p=0.0457$, see Figure 2B).

Only two group differences proved to be significant on the basis of PAR potentiation per image type. SZ showed a smaller potentiation for both food-related ($F_{(1,24)}=5.9127$, $p=0.0232$), and nurturing images ($F_{(1,24)}=4.7779$, $p=0.0393$, See figure 2C-D). Potentiation for food-related images also showed a negative correlation with negative symptoms ($F_{(1,14)}=6.0196$, $p=0.0290$).
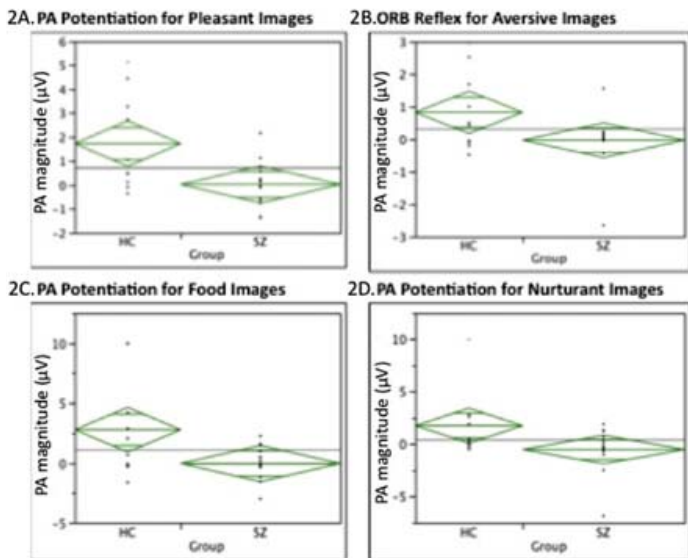
Figure 2. Postauricular and startle blink modulation by picture valence, with group differences in PAR potentiation by stimuli.

DISCUSSION.

The potentiation of the PAR in controls was overall greater than that of SZ patients (Figure 2). This suggests that patients with schizophrenia do not respond in the same way as healthy controls to emotional stimuli. In particular this implies that positive emotional stimuli, those that elicit PAR of the greatest magnitude, do not have as much effect on SZ patients. This indicates that SZ patients are not responding emotionally to these images, and that they do not experience positive emotion as strongly as control subjects. Specifically, SZ patients were less responsive to nurturant and food scenes.

The startle-blink responses were consistent with the hypothesis going into the study: HC had a higher startle blink reflex (ORB) to aversive images that SZ. This shows that the emotional response of the SZ group is somewhat blunted for both pleasant and aversive emotions, consistent with the flat affect noted in SZ [3].

However, there were no group differences in image ratings. This means that across the board, HC and SZ thought that the image valences were basically the same. This shows that the only truly changing variables were the biological responses of the participants.

This study was limited in that the control and patient groups were not matched up statistically as well as they could have been. A larger sample of control subjects, at least to the same size as the patient group, would help to ensure that the patterns in the data would be strongly correlated. More controls would definitely contribute to the robustness of the data, and the correlations showed would be more reliable from a statistical standpoint. In the future, due to the inherent variability of EMG and EEG data, more subjects should be tested to allow for significant abnormalities or technical errors.

This study points forward to the use of psychophysiology to measure emotion, especially in disorders such as schizophrenia. Because biological measures were more sensitive to individual differences in emotion than self-reports in this study, psychological dysfunctions such as flat affect and anhedonia can be looked at in-depth using similar methods. This study warrants future use of the PAR technique to further investigate emotional processing in schizophrenic patients.

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