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Cerebral information processing in personality disorders: I. Intensity dependence of auditory evoked potentials

Wei Wang [a,e,*], Yehan Wang [a], Xianming Fu [a], Jianhui Liu [b], Chengsen He [b], Yi Dong [c], W. John Livesley [d], Kerry L. Jang [d]

[a] *Division of Neuropsychology and Psychotherapy, Anhui Institute of Stereotactic Neurosurgery, Anhui Provincial Hospital, Hefei, China*
[b] *Center of Psychological Counseling, Anhui Medical University, Hefei, China*
[c] *Department of Psychiatry, Hefei Psychiatric Hospital, Hefei, China*
[d] *Department of Psychiatry, University of British Columbia, Vancouver, Canada*
[e] *Department of Medical Psychology, Zhejiang University School of Medicine, Hangzhou, China*

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Abstract

Patients with personality disorders such as the histrionic type exaggerate their responses when receiving external social or environmental stimuli. We speculated that they might also show an augmenting pattern of the auditory evoked potential N1–P2 component in response to stimuli with increasing levels of intensity, a response pattern that is thought to be inversely correlated with cerebral serotonin (5-HT) activity. To test this hypothesis, we collected auditory evoked potentials in 191 patients with personality disorders (19 patients with the paranoid type, 12 schizoid, 14 schizotypal, 18 antisocial, 15 borderline, 13 histrionic, 17 narcissistic, 25 avoidant, 30 dependent and 28 obsessive-compulsive) and 26 healthy volunteers. Their personality traits were measured using the Dimensional Assessment of Personality Pathology-Basic Questionnaire (DAPP-BQ). Compared with healthy subjects and other patient groups, the histrionic group scored higher on the basic traits Affective Instability, Stimulus Seeking, Rejection and Narcissism, and on the higher traits Emotional Dysregulation and Dissocial, than the other groups, and the schizoid group scored lower on most of the DAPP-BQ basic and higher traits. In addition, the histrionic group showed steeper amplitude/stimulus intensity function (ASF) slopes at three midline scalp electrodes than the healthy controls or the other patient groups. The ASF slopes were not correlated with any DAPP-BQ traits in the total sample of 217 subjects. However, the DAPP-BQ basic trait Rejection was positively correlated with the ASF slopes at all three electrode sites in the histrionic group. The increased intensity dependence of the auditory N1–P2 component might indicate that cerebral 5-HT neuronal activity is, on average, weak in the histrionic patients.

Keywords: Auditory evoked potential; Dimensional assessment of personality pathology; Intensity dependence; Personality disorder

* Corresponding author. Department of Medical Psychology, Zhejiang University School of Medicine, Yan'an Road 353, Hangzhou, Zhejiang 310031, China. Tel.: +86 571 87217161; fax: +86 571 87217184.
E-mail addresses: DrWang@Doctor.com, wangmufan@msn.com (W. Wang).

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1. Introduction

The classification of personality disorders, e.g., in the Diagnostic and Statistical Manual of Mental Disorders (DSM, American Psychiatric Association, 1994), has been challenged by approaches that rely upon a dimensional description of personality traits (Costa and Widiger, 1994; Cloninger, 2000). The Five-Factor Model of normal personality appears to be systematically related to broadly defined personality disorders rather than to specific diagnostic categories of personality disorder (Coolidge et al., 1994; Clark et al., 1997; Morey et al., 2002). It also lacks specificity in differentiating personality disorders and Axis I pathology (Butcher and Rouse, 1996; Davis and Millon, 1993; McAdams, 1992). Because it is difficult to distinguish trait- from state-related characteristics, many measures of disordered personality used in clinical settings also fail to generate reliable results across different studies (Livesley, 2001). Nonetheless, the predictable link between the dimensional models and the DSM diagnoses (Clark et al., 1996; McCrae et al., 2001; Reynolds and Clark, 2001; Trull et al., 2001) has its biological background (reviewed in Coccaro, 2001). Whether there are other forms of evidence that could serve to strengthen the link, e.g., by neurocognitive responses, is unclear.

The sensory cortex responds to peripheral input, and auditory, somatosensory, visual or other stimuli evoke a cortical response that can be quantified by the latency and amplitude of the evoked potential. In cerebral evoked potential studies, the potential amplitude may increase or decrease with stimulus intensity, termed the intensity-dependence phenomenon, or earlier called augmenting/reducing (Buchsbaum and Silverman, 1968). The augmenting-reducing phenomenon was first reported in the visual modality and soon after in the auditory modality in healthy subjects (e.g., Blenner and Yingling, 1993; for review, see Buchsbaum et al., 1975; Buchsbaum, 1976) and in paranoid schizophrenia and affective disorders (reviewed in Buchsbaum, 1975, 1977). Studies have shown that the intensity dependence is reliable in the auditory evoked N1–P2 amplitude (Hegerl and Juckel, 1993; Carrillo-de-la-Pena, 2001). As demonstrated recently using brain electrical source analysis, the intensity dependence of the auditory N1–P2 is more pronounced in the superior temporal plane, which is supposed to reflect mainly activity of the primary auditory cortex, rather than the secondary auditory areas in the lateral temporal cortex (Scherg et al., 1989; Scherg and von Cramon, 1990; Hegerl et al., 1994).

It is worthy of note that there might be a positive relationship between the intensity dependence of evoked potentials and the sensation seeking/impulsivity personality trait (Zuckerman et al., 1993) in healthy subjects (reviewed in Carrillo-de-la-Pena, 1992) and in alcohol-dependent patients (Hegerl et al., 1995; Herrmann et al., 2002), although no correlation was found in another sample of young students (Carrillo-de-la-Pena, 2001) or in migraine sufferers (Wang et al., 1999). On the other hand, the intensity dependence of the evoked potential has also been studied in depression (Paige et al., 1994; Brocke et al., 2000) and obsessive-compulsive disorder (Carrillo-de-la-Pena et al., 2000). Since layer IV of the temporal cortex receives most of the specific thalamic sensory input (Winer, 1984; Zilles, 1990) and is rich in modulatory serotonin (5-HT) neurons (McCormick, 1992), it has been hypothesized that the intensity dependence of the auditory evoked N1–P2 component is inversely related to cortical 5-HT neuronal activity (Hegerl and Juckel, 1993).

Many neurotransmitters, including 5-HT, have been linked to personality disorders (reviewed in Depue and Lenzenweger, 2001), and we speculate that certain personality traits may be correlated with the intensity dependence of the auditory N1–P2 components. For instance, patients with histrionic and borderline personality disorders tend to be sensation seekers. In particular, patients with histrionic personality are highly expressive, dramatic, attention seeking, overly gregarious, seductive and manipulative (Widiger and Sankis, 2000; Cale and Lilienfeld, 2002). Therefore, we hypothesize that (1) the intensity dependence of the auditory N1–P2 component might be more pronounced in patients with histrionic and borderline personality disorders and (2) the intensity dependence might be correlated with Stimulus Seeking (similar to “sensation seeking”) as described in the Dimensional Assessment of Personality Pathology-Basic Questionnaire (Livesley and Jackson, in press).