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Quantitative electroencephalographic measures in homicidal men with antisocial personality disorder

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Abstract

Many symptoms of antisocial personality disorder have been proposed to be related to decreased daytime vigilance. To explore this hypothesis, quantitative analyses were conducted of the electroencephalographic (EEG) activity of drug-free and detoxified homicidal male offenders with antisocial personality disorder as the primary diagnosis. Subjects comprised 16 men recruited from a forensic psychiatric examination in a special ward of a university psychiatric hospital. Fifteen healthy age- and gender-matched controls with no criminal record or history of physical violence consisted of hospital staff and students. An overall reduction of alpha power was observed in the waking EEG of offenders. A bilateral increase in occipital delta and theta power was also found in these individuals. This study provides further support to the growing evidence of brain dysfunction in severe aggressive behavior. Homicidal offenders with antisocial personality disorder seem to have difficulties in maintaining normal daytime arousal. Decreased vigilance, together with social and psychological variables, may explain their aberrant behavior in everyday life. New studies are, however, needed to specify the vigilance problems of this patient group.

Keywords: Quantitative EEG; Antisocial personality disorder; Homicide; Aggression; Vigilance

1. Introduction

Aggressive behavior presents a challenge to research as well as to the health care system. The economic and social cost of violent behavior is enormous (Scott et al., 2001), and thus far, both pharma-

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cological and behavioral treatment interventions have been ineffective (Gerardin et al., 2002). As a symptom, aggression cuts across a number of psychiatric disorders, but it is most closely related to antisocial personality disorder (ASP) (Eronen et al., 1996; Virkkunen et al., 1996). This disorder is associated with a pervasive pattern of disregard for and violation of the rights of others, and not surprisingly, the highest prevalence rates of ASP are found in prisons and forensic settings (American Psychiatric Association, 2000).

Several studies from earlier decades have described abnormalities in the visual analysis of the waking electroencephalogram (EEG) of antisocial persons. In a review of 1500 so-called psychopaths, the most prominent form of EEG abnormality was the presence of delta and theta activity (Ellingson, 1954). In a study of severely aggressive psychopaths (Hill, 1952), the abnormal activity was localized in the temporal lobes of the cerebral hemispheres. Within the psychopathic group, the temporal abnormality was more severe in highly aggressive individuals. Among children with severe behavior problems, including poor impulse control and inadequate socialization, the most frequent forms of waking EEG abnormality also included temporal theta and delta activity (Bayrakal, 1965). Forssman and Frey (1953) reported that antisocial boys with behavioral problems had difficulties in maintaining normal arousal levels during EEG recording. These findings prompted Hare (1970) to formulate the slow arousal theory, which accounts for many aspects of the behavior of antisocial persons, including impulsivity, aggressiveness and the desire for immediate gratification. He suggested that antisocial individuals, with their pathologically low level of cortical arousal, were hypoactive compared with normal individuals and consequently existed in a chronic stage of "stimulus hunger".

Whereas earlier studies were generally more qualitative, waking EEG technology has increasingly allowed detailed quantitative computerized analysis along with clinical visual inspection. The diagnostic criteria of psychiatric disorders have also become more precise during the same time frame. In the study by Convit et al. (1991) of male psychiatric inpatients with violent behavior, the number of instances of violence and the number of staff interventions were related to increased delta band activity and to decreased alpha band activity in the temporal and parieto-occipital areas. Furthermore, the results demonstrated that violence was very significantly related to hemispheric asymmetry in the EEG for the frontotemporal derivations. Unfortunately, almost all subjects in this study were receiving neuroleptic medication, and no control group was included for the EEG analysis. Wong et al. (1994), in examining among nearly 400 male patients with a variety of axis I and axis II psychiatric disorders in a maximum-security mental hospital, found high violence rating scores to be associated with abnormal temporal electrical discharges. Among children and adolescents, slowing of alpha activity has been associated with later delinquency, with thefts in particular (Mednick et al., 1981; Petersén et al., 1982). Raine et al. (1990a,b) reported a retrospective study of 101 males and showed that adult criminals at the age of 24 had significantly more slow-frequency EEG activity as well as decreased reactivity of the autonomic nervous system than non-criminals when measured at the age of 15 years. The authors speculated that, in addition to social and psychological variables, measures of central nervous system underarousal may facilitate the prediction of subsequent antisocial behavior and may even elucidate the etiological basis of criminality. However, the offender populations in these three retrospective studies did not contain persons with severe antisocial behavior. In a quantitative EEG study in a forensic population with various psychiatric diagnoses, significant increases in slow-wave activity in the temporal lobes of persons charged with either murder or manslaughter were found (Gatzke-Kopp et al., 2001).

The aim of the study was to analyze the quantitative EEG of habitually violent, drug-free and detoxified homicidal male offenders with ASP as the primary clinical diagnosis. The hypothesis was that the daytime vigilance of these men would be lower than that of age- and gender-matched healthy controls.

2. Methods

2.1. Participants

Subjects comprised 19 males with a history of recurrent violent acts. Because of technical problems or artifacts in the quantitative EEG, three men were