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Relationship between impulsivity and platelet serotonin content in adolescents

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Abstract

The relationship between impulsivity and serotonin function was explored in impulsive and non-depressed adolescents. Platelet serotonin content was chosen as a peripheral indicator of central serotonin function. Impulsivity was assessed with a questionnaire. All measures were performed once a week over a 6-week period for all subjects. Subjects comprised eight adolescent inpatients who were hospitalized as a result of their impulsive acts and eight healthy age- and sex-matched control subjects. Mean platelet serotonin concentration was significantly higher in the impulsive group than in the control group. Platelet serotonin concentration was positively correlated with the intensity of impulsivity in the patient group. © 2000 Elsevier Science Ireland Ltd. All rights reserved.

Keywords: Serotonin; Impulsive acts; Aggression; Violence

1. Introduction

Over the last two decades, many clinical and animal studies have documented an association between indices of low serotonin turnover and

different nosologic entities that are characterized by poor impulse control (Brown et al., 1982; Linnola et al., 1983; Schalling et al., 1983; Soubrié, 1986; Stoff et al., 1986; van Praag, 1986; Pliszka et al., 1988; Roy et al., 1988; Coccaro et al., 1989; Kruesi et al., 1990; Martin et al., 1990; Candito et al., 1993; Coccaro et al., 1996; Schalling and Åsberg, 1997; Unis et al., 1997). In most studies, patients have been selected on the basis of DSM diagnostic categories, a practice that seems incon-

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sistent with the dimensional conception of impulsivity; indeed, impulsivity seems to cut across nosological categories (Apter et al., 1990). For this reason, some investigators (van Praag et al., 1987, 1991; Lecrubier, 1988) have presented compelling arguments for avoiding the limitation imposed by current nosological schemes. They have suggested that biological markers, including measures of serotonergic function, may be more closely related to basic psychopathologic dimensions, such as impulsivity, than to specific current diagnostic categories.

In adolescent psychiatry, studies on impulsivity are less common and have been limited by ethical and practical constraints. One study found that cerebrospinal fluid (CSF) levels of 5-hydroxyindoleacetic acid (5-HIAA) were lower in children and adolescents with disruptive behavior disorders than in children and adolescents with obsessive-compulsive disorders (Kruesi et al., 1990). Two other studies, which were confined to peripheral measures, found a positive relationship between whole blood serotonin content and ratings of conduct disorders (Pliszka et al., 1988) in juvenile offenders and of violence (Unis et al., 1997) in adolescents with conduct disorders. The clinical status of impulsivity, as a trait or a state, is unclear. One commonly used research measure, The Barratt Impulsiveness Scale (Patton et al., 1995), was clearly constructed to measure a personality trait and, as such, has been largely validated in normal rather than inpatient populations.

The present study was designed to investigate, in an adolescent population, the relationship of platelet serotonin content to impulsivity, irrespective of clinical diagnosis. Impulsivity was measured with a new questionnaire, the Impulsivity Rating Scale (Lecrubier et al., 1995).

2. Methods

2.1. Design of the study

To test our hypothesis, a research design involving weekly repeated measures was chosen. After verification of inclusion criteria, clinical

evaluations and blood sampling were performed at a similar time of the day for 6 weeks.

2.2. Procedure for measurement of platelet serotonin content

Blood (2 ml) samples were taken from both fasting patients and control subjects by venipuncture at 09.00 h once a week at baseline, and then for 5 consecutive weeks only from the patients. Blood was drawn into a silicone-coated glass vacutainer tube (B-326-SDW-45) containing buffered sodium citrate and placed on ice. Platelet-rich plasma was obtained by centrifugation at $180 \times g$ for 15 min at room temperature. Platelets were counted with a Coulter S + 4 Counter. The sample was then frozen at -20°C . The mean interval between sample collection and performance of the assay was 2 weeks, and the maximum delay before assay was 1 month. Ascorbic acid (7.5 mg/ml) and internal standard ($\alpha\text{CH}_3\text{-5HT}$) were added to 500 μl of platelet-rich plasma. The serotonin (5HT) concentration was determined by high performance liquid chromatography with electrochemical detection (Koch and Kissinger, 1979).

2.3. Clinical assessment

A trained, experienced psychiatrist performed clinical assessments on both patients and control subjects. All subjects were screened for impulsive behaviors, and diagnoses were established according to DSM-III-R criteria (American Psychiatric Association, 1987). The Montgomery-Åsberg Depression Rating Scale (MADRS; Montgomery and Åsberg, 1979) and the Hamilton Anxiety Rating Scale (HARS; Hamilton, 1969) were used to evaluate depression and anxiety, respectively. Impulsivity was measured using the Impulsivity Rating Scale (IRS; Lecrubier et al., 1995), which is based on the description of the patient's current behavior in usual situations and includes the following seven items: Irritability, Impatience, Time needed for decision, Capacity to pursue an activity, Aggressivity, Control of response, and Ability to delay. When rating the items, the examiner only takes the last week into account. For each item,

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