Trait impulsivity and response inhibition in antisocial personality disorder

Alan C. Swann *, Marijn Lijffijt, Scott D. Lane, Joel L. Steinberg, F. Gerard Moeller

Department of Psychiatry and Behavioral Sciences, University of Texas Health Science Center, 1300 Moursund Street, Room 270, Houston, TX 77030, USA

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ABSTRACT

Background: Impulsive behavior is a prominent characteristic of antisocial personality disorder. Impulsivity is a complex construct, however, representing distinct domains of cognition and action. Leading models refer to impulsivity as an inability to evaluate a stimulus fully before responding to it (rapid-response impulsivity), and as an inability to delay responding despite a larger reward (reward-delay impulsivity). We investigated these models in terms of the diagnosis and severity of antisocial personality disorder.
Methods: Thirty-four male subjects on probation/parole who met DSM-IV criteria for ASPD, and 30 male healthy comparison subjects, matched by ethnicity, were recruited from the community. The Barratt Impulsiveness Scale (BIS-11) provided an integrated measure of trait impulsivity. Rapid-response impulsivity was assessed using the Immediate Memory Task (IMT), a continuous performance test. Reward delay impulsivity was assessed using the Two-choice Impulsivity Paradigm (TCIP), where subjects had the choice of smaller-sooner or larger-delayed rewards, and the Single Key Impulsivity Paradigm (SKIP), a free-operant responding task.
Results: Compared to controls, subjects with ASPD had higher BIS-11 scores (Effect Size (E.S.) = 0.95). They had slower reaction times to IMT commission errors (E.S. = 0.45). Correct detections, a measure of attention, were identical to controls. On the SKIP, they had a shorter maximum delay for reward (E.S. = 0.76), but this was not significant after correction for age and education. The groups did not differ on impulsive choices on the TCIP (E.S. < 0.1). On probit analysis with age and education as additional independent variables, BIS-11 score, IMT reaction time to a commission error, and IMT positive response bias contributed significantly to diagnosis of ASPD; SKIP delay for reward did not. Severity of ASPD, assessed by the number of ASPD symptoms endorsed on the SCID-II, correlated significantly with commission errors (impulsive responses) on the IMT, and with liberal IMT response bias. This relationship persisted with correction for age and education.
Discussion: These results suggest that ASPD is characterized by increased rapid-response impulsivity. Aspects of impulsivity related to reward-delay or attention appear relatively intact.

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1. Introduction

Impulsivity, defined as a propensity to act without the apparent capacity to adapt behavior to contextual demands, is prominent in many psychiatric disorders (Moeller et al., 2001). Impulsivity is complex, comprising neural mechanisms that could relate to distinct aspects of cognition. Two mechanisms involved in impulsivity, which may differ in mechanisms and treatments, are the inability to evaluate a stimulus adequately before responding to it (rapid-response impulsivity), and the inability to delay responding to an immediate small reward for a delayed larger one (reward-delay or delay-discounting impulsivity) (Swann et al., 2002; Evenden, 1999).

Impulsivity plays a central role in the so-called Cluster B personality disorders, including antisocial personality disorder (ASPD) (American Psychiatric Association, 1995; First et al., 1997). ASPD is a common and potentially dangerous disorder, characterized by poor impulse control and destructive behavior that begins in childhood and persists into adulthood (American Psychiatric Association, 1995). In contrast with positive effects of treatment in individuals with impulsive aggression (Sheard et al., 1976; Barratt et al., 1997; Stanford et al., 2005), there is no systematic or reliably effective treatment specifically for ASPD.

1.1. ASPD and impulsivity

There is relatively little information on quantitative measures of impulsivity in ASPD. An integrated questionnaire measure of impulsivity, the Barratt Impulsiveness Scale (BIS-11) (Barratt and Patton, 1983) is increased in adults with histories of conduct disor-

* Corresponding author. Tel.: +1 713 500 2555; fax: +1 713 500 2530.
E-mail address: Alan.C.Swann@uth.tmc.edu (A.C. Swann).

der (Dougherty et al., 2000a), adults with ASPD or with adult antisocial behavior (Lijffijt et al., in press), and in adolescents with disruptive behavior disorders (Dougherty et al., 2003) and their parents (Swann et al., 2002). BIS-11 Motor impulsiveness, related to acting without thinking, was increased in subjects with ASPD who were identified in a nonclinical sample (Fossati et al., 2004) and correlated with symptoms of ASPD and borderline personality disorder (Fossati et al., 2004, 2007).

In subjects with ASPD and substance-use disorders, there appears to be an additive increase in reward-delay impulsivity, though the task used fictitious rewards and there was no group with ASPD only (Petry, 2002). A study of ASPD and alcohol-use disorder found reward-delay impulsivity to be increased as a marker for alcohol-use disorder, but rapid-response impulsivity (measured using a CPT) to be increased largely in the subgroup of subjects with both alcohol-use disorder and a Cluster B personality disorder (ASPD or borderline personality disorder) (Rubio et al., 2007). Similarly, another study found that subjects with ASPD performed normally on the Iowa Gambling Task but had impaired performance in a Stroop test designed to measure impulsivity (Vassileva et al., 2007).

Impulsivity, therefore, appears to be a core characteristic of ASPD that may link it to other Cluster B personality disorders, and may relate more to an inability to withhold responding until stimuli are fully processed (rapid-response) than to an inability to delay responding for a larger reward. However, the evidence is limited. Other characteristics commonly found in subjects with ASPD may confound assessment of the specific role of impulsivity. For example, impulsivity has complex potential relationships with education, since impulsivity can interfere with completion of education and education can provide tools to compensate for impulsivity (Nusslock et al., 2008). We have reported that impulsivity in either clinical or nonclinical samples is potentially influenced by age and education (Swann et al., in press-a,b). Ethnicity also may alter the relationship between impulsivity and antisocial traits (Jackson et al., 2007).

1.2. Aims and hypotheses

We have compared impulsivity in subjects with ASPD to that in controls. We used (1) an integrated measure of impulsivity, the BIS-11, (2) the Immediate Memory Task (IMT), a measure of rapid-response impulsivity based on the Continuous Performance Test, and (3) the Single Key Impulsivity Paradigm (SKIP) and Two-Choice Impulsivity Paradigm (TCIP), measures of ability to delay response for a larger reward. Our hypotheses were that subjects with ASPD would have (1) higher BIS-11 scores than controls, (2) abnormal performance on the IMT consistent with greater rapid-response impulsivity, and (3) relatively intact performance on the TCIP or SKIP, tests of ability to delay reward. In terms of these hypotheses, we investigated characteristics of impulsivity in subjects with ASPD and healthy controls, evaluating potential roles of age, education, and ethnicity, and relationships to severity of ASPD symptoms.

2. Methods

This study was reviewed and approved by the Committee for the Protection of Human Subjects (CPHS), the IRB for The University of Texas Health Science Center at Houston. Before any research-related procedures were carried out, the study was explained thoroughly to subjects and they were given ample opportunity to answer any questions. Subjects then signed informed consent documents approved by the CPHS. All advertisements, flyers, and other study-related material had prior CPHS approval.

2.1. Subjects

Subjects were recruited through advertisements in the local press for healthy subjects or for subjects who were on probation/parole. The ASPD group included 34 men and only 5 women; the analyses in this report were limited to men. Healthy controls (not meeting DSM-IV criteria for any Axis I or II disorder including substance-related disorders) included 36 men but 6 were Asians, while no ASPD subjects were Asian, so the Asian controls were excluded from the current analysis, leaving 30 healthy comparison subjects. ASPD subjects could have histories of substance or alcohol abuse or dependence, and could have current substance or alcohol use, but were excluded if they currently met DSM-IV criteria for alcohol or other substance abuse or dependence. All subjects with ASPD and histories of a substance-use disorder met criteria for ASPD at an earlier age than that at which they met criteria for a substance-use disorder. At the time that they were studied, subjects were required to have negative screens for drugs of abuse (urine) and alcohol (breath).

2.2. Measures

2.2.1. Diagnostic

Diagnoses were rendered using the SCID-II (First et al., 1997); the SCID-I was also administered in order to identify comorbidities and to assure that subjects did not have schizophrenia or bipolar disorder, exclusion criteria (First et al., 1996). Raters were trained in these instruments, using standard training tapes and manuals. Diagnoses from structured clinical interviews were verified in consensus meetings that included co-authors A.C.S., J.L.S., and F.G.M.

2.2.2. Barratt Impulsiveness Scale (BIS-11)

This BIS-11 is a well-validated 30-item self-rated measure of impulsivity as a stable trait (Barratt and Patton, 1983). It has three oblique factors: attentional impulsivity, measuring cognitive instability; motor impulsivity, measuring impetuousness and acting on the spur of the moment; and nonplanning impulsivity, measuring lack of a sense of the future (Patton et al., 1995).

2.2.3. Rapid-response impulsivity: Immediate Memory Task (IMT)

The IMT is a continuous Performance Test developed to assess impulsivity and attention (Dougherty et al., 2000b). Five-digit numbers are displayed on a computer screen for 0.5 s, with 0.5 s between stimuli. Subjects are instructed to respond as quickly as possible when they see a number that matches the previous one. There are three types of responses: correct detections (CD), where the stimulus exactly matches the one before it; commission errors (CE), where 4 of 5 digits match (the position in the 5-digit sequence of the nonmatching digit is varied randomly); and filler errors, where the number has no relationship to the one before it. Reaction times to CD or CE are also measured, and there are two parameters derived from signal detection theory: discriminability, ranging from 0.5 to 1, where a higher value reflects ability to distinguish target from off-target stimuli (A'), and response bias (beta), ranging from −1 to 1, where a higher value reflects a conservative response bias with low rates of commission errors but also of correct detections (Donaldson, 1992; Green and Swets, 1966).

2.2.4. Reward-delay impulsivity: Single Key Impulsivity Paradigm (SKIP)

The SKIP is a free-operant responding test designed to measure ability to delay response for a larger reward (Dougherty et al., 2005, 2003). Unlike two-choice tests, the duration of the task does not depend on responses by the subject. Subjects are instructed that they can press a button to obtain money, and that the longer they wait, the more money they will get. The amount obtained