Progress in Neuro-Psychopharmacology & Biological Psychiatry 38 (2012) 336–340

Contents lists available at SciVerse ScienceDirect

Progress in Neuro-Psychopharmacology & Biological Psychiatry

journal homepage: www.elsevier.com/locate/pnp

Neurocognitive dysfunction in strategic and non-strategic gamblers☆,☆☆

Jon E. Grant [a,*], Brian L. Odlaug [a], Samuel R. Chamberlain [b], Liana R.N. Schreiber [a]

[a] Department of Psychiatry, University of Minnesota School of Medicine, Minneapolis, MN, United States
[b] Department of Psychiatry, University of Cambridge, Addenbrooke's Hospital, Cambridge, United Kingdom

ARTICLE INFO

Article history:
Received 1 December 2011
Received in revised form 20 April 2012
Accepted 11 May 2012
Available online 18 May 2012

Keywords:
Cognition
Gambling
Impulsivity

ABSTRACT

Objective: It has been theorized that there may be subtypes of pathological gambling, particularly in relation to the main type of gambling activities undertaken. Whether or not putative pathological gambling subtypes differ in terms of their clinical and cognitive profiles has received little attention.
Method: Subjects meeting DSM-IV criteria for pathological gambling were grouped into two categories of preferred forms of gambling — strategic (e.g., cards, dice, sports betting, stock market) and non-strategic (e.g., slots, video poker, pull tabs). Groups were compared on clinical characteristics (gambling severity, and time and money spent gambling), psychiatric comorbidity, and neurocognitive tests assessing motor impulsivity and cognitive flexibility.
Results: Seventy-seven subjects were included in this sample (45.5% females; mean age: 42.7 ± 14.9) which consisted of the following groups: strategic (n = 22; 28.6%) and non-strategic (n = 55; 71.4%). Non-strategic gamblers were significantly more likely to be older, female, and divorced. Money spent gambling did not differ significantly between groups although one measure of gambling severity reflected more severe problems for strategic gamblers. Strategic and non-strategic gamblers did not differ in terms of cognitive function; both groups showed impairments in cognitive flexibility and inhibitory control relative to matched healthy volunteers.
Conclusion: These preliminary results suggest that preferred form of gambling may be associated with specific clinical characteristics but are not dissociable in terms of cognitive inflexibility and motor impulsivity.

1. Introduction

Epidemiological studies estimate that the prevalence of lifetime pathological gambling among adults in the United States is 0.4–1.5% (Cunningham-Williams et al., 1998; Petry et al., 2005; Shaffer et al., 1999). Gambling activities range from informal games of chance to formalized and legal options (Hodgins et al., 2011). Problems with cognitive functions dependent on fronto-striatal circuitry have been strongly implicated in the pathophysiology of the disorder (Clark, 2010). Knowledge of problems with cognitive functions, and how these may differ between gambling subtypes, may be vital in improving neurobiological models and identifying candidate treatments.

Multiple studies have examined cognitive functions in gamblers across a range of domains (e.g., Goudriaan et al., 2005; Hodgins et al., 2011; Petry, 2005). Goudriaan and colleagues compared decision-making functions between pathological gamblers, alcohol dependent individuals, Tourette's syndrome, and healthy controls, using several tasks (including the Iowa Gambling Task, IGT) (Gourdriaan et al., 2005). Pathological gamblers showed a range of deficits on the tasks versus healthy controls, as did alcohol dependent individuals, with individuals with Tourette's syndrome being relatively free of cognitive problems. Elsewhere, deficits on response inhibition performance (i.e. increased motor impulsivity) have been reported in pathological gamblers (Fuentes et al., 2006; Goudriaan et al., 2006; Kertzman et al., 2008; Odlaug et al., 2011a). Studies examining cognitive flexibility have been mixed, with most studies reporting deficits on the Wisconsin Card Sorting Test (WCST) or the intra-dimensional/extra-dimensional (IDED) in pathological gamblers (Forbush et al., 2008; Goudriaan et al., 2006; Marazziti et al., 2008) and a minority showing no deficits (Cavedini et al., 2001) in terms of cognitive flexibility.

Abbreviations: IGT, Iowa Gambling Task; WCST, Wisconsin Card Sorting Test; IDED, Intra-Dimensional Extra-Dimensional; SST, Stop Signal Test; DSM-IV, Diagnostic and Statistical Manual of Mental Disorders, Fourth Edition; SCI-PG, Structured Clinical Interview for Pathological Gambling; SCID-I, Structured Clinical Interview for DSM-IV Axis I Disorders; PG-YBOCs, Yale-Brown Obsessive-Compulsive Scale Modified for Pathological Gambling; HAM-D, Hamilton Depression Rating Scale; HAM-A, Hamilton Anxiety Rating Scale; ANOVA, Analysis of Variance; G-SAS, Gambling Symptom Assessment Scale; CGI, Clinical Global Impression Scale.

☆ All assessments were conducted in the Ambulatory Research Center of the Department of Psychiatry, University of Minnesota, Minneapolis, MN, USA.

☆☆ Funding: This research is supported by a Center for Excellence in Gambling Research grant by the Institute for Responsible Gaming and an American Recovery and Reinvestment Act (ARRA) grant from the National Institute on Drug Abuse (1RC1DA028279-01) to Dr. Grant.

* Corresponding author at: Department of Psychiatry, University of Minnesota School of Medicine, 2450 Riverside Avenue, Minneapolis, MN 55454, United States. Tel.: +1 612 273 9736; fax: +1 612 273 9779.
E-mail address: grant045@umn.edu (J.E. Grant).

0278-5846/$ – see front matter © 2012 Elsevier Inc. All rights reserved.
doi:10.1016/j.pnpbp.2012.05.006

Gambling activities have historically been divided into two groups: strategic and non-strategic. Non-strategic games involve little or no decision making or skill, and gamblers cannot influence the outcome of the game (e.g., slot machines, pull tabs, bingo, and keno). By contrast, strategic games allow gamblers to attempt to use knowledge of the game to influence or predict the outcome (e.g., poker, blackjack, dog and horse racing, sports betting, and craps/dice games) (Odlaug et al., 2011b). Studies examining preferred style of gambling have found that high rates of "action" or arousal-seeking behavior are reasons for men preferring strategic forms while escaping from emotional trauma may underlie the non-strategic preferences of women (Ledgerwood and Petry, 2006; Potenza et al., 2001). Whether or not these putative subtypes differ in terms of cognitive dysfunction, and by implication underlying neural dysfunction, has received little attention. In the Goudriaan et al. (2005) study, a subgroup analysis in the pathological gambling group found that slot machine gamblers performed significantly worse than casino gamblers on the decision-making tasks. Myrseth and colleagues have reported that gamblers preferring skill games or both skill and chance games scored higher in terms of the cognitive distortion of 'illusion of control' compared to gamblers preferring chance games alone (Myrseth et al., 2010). Studies indicate that gambling preference may be clinically significant and provide a means of subtyping individuals with pathological gambling (Potenza et al., 2001). The goal of the current study was to significantly expand on the above work by examining clinical and cognitive characteristics (response inhibition and cognitive flexibility) of gamblers based on preference of gambling activity. Understanding cognitive differences in these subgroups of gamblers may allow for more targeted treatments. Two translational computerized neurocognitive paradigms that have been widely utilized elsewhere, the stop-signal test (SST) and intra-dimensional/extra-dimensional (IDED) set-shift test, were used in this sample. Computerized tests such as these offer potential advantages in that the neural and neurochemical substrates have been explored in translational models across species (Chamberlain et al., 2011). These two tests were selected since response inhibition and set-shifting had not been studied as a function of preferred gambling type, despite past research finding pathological gamblers may have impairments in these two cognitive domains. Based on existing findings for other tasks (Goudriaan et al., 2005), we hypothesized that non-strategic gamblers would show disproportionately greater impairment than strategic gamblers in terms of response inhibition and set-shifting; and that both these groups would be impaired compared to healthy controls.

2. Method

2.1. Subjects

Patient participants included 77 adults aged ≥18 years meeting current (past-12-months) DSM-IV criteria for pathological gambling using the Structured Clinical Interview for Pathological Gambling (SCI-PG) (Grant et al., 2004). Subjects were enrolled in a clinical research trial investigating the effectiveness of memantine hydrochloride (Grant et al., 2010) or n-acetyl cysteine (in progress) for pathological gambling. Inclusion criteria were a current DSM-IV diagnosis of pathological gambling and the ability to provide written informed consent. Subjects with lifetime psychotic or bipolar disorders were excluded as were subjects with current (past 12-months) substance abuse or dependence. If taking psychotropic medication at the time of screening, subjects were required to have been on a stable dose of medication for at least six-weeks. Current classes of psychiatric medication being taken were: non-strategic (SRI = 6; stimulant = 1); strategic (SRI = 4).

Healthy controls were recruited using media advertisements in the local community. From this pool of normative data, a sample of age- and gender-matched healthy controls (n = 28) was identified by a researcher independent of the current study, in order to provide a comparator for neurocognitive performance in patients. Controls were required to have no current or lifetime DSM-IV Axis I or II psychiatric illness.

The study procedures were carried out in accordance with the Declaration of Helsinki. The Institutional Review Board of the University of Minnesota approved the study and the consent procedures. All assessments were conducted by board certified psychiatrists and psychologists familiar with pathological gambling. After complete description of the study to the participants, voluntary written informed consent was obtained.

2.2. Assessments

At the intake interview, board-certified psychiatrists (JEG, SWK) assessed each subject using the Structured Clinical Interview for DSM-IV Axis I Disorders (SCID-I; Frist et al., 1995) and the Structured Clinical Interview for Pathological Gambling (SCI-PG), a valid and reliable diagnostic instrument (Grant et al., 2004). In addition to a psychiatric assessment, a semi-structured rater-administered questionnaire was used to collect detailed information on demographic and clinical features of pathological gambling (e.g., preferred types of gambling, amount of money lost, problems related to gambling). All subjects included in this analysis were drawn from a sample of outpatient individuals responding to an advertisement for "*gamblers seeking treatment*" in Minnesota where multiple types of gambling (i.e., both strategic and non-strategic) are available.

To determine preferred form of gambling, subjects were asked as part of the semi-structured clinical interview, which form of gambling they preferred. Strategic gambling was defined as games (e.g., cards, sports, and dog/horse-race wagering) in which skill or knowledge may have some impact on outcomes (Petry, 2003) and is based upon previous research (Nower and Blaszczynski, 2006; Odlaug et al., 2011b; Potenza et al., 2000). Other games such as slots, lottery, and pull tabs, require little concentration and no skill. In the case of slot machines, although the choice of machine is made by the user, the choices the gambler makes thereafter have little to no impact on the outcome of the game. The same holds true in lottery and pull-tab play. Consequently, these are categorized as 'non-strategic' gambling.

Current pathological gambling symptom severity was assessed using multiple valid and reliable measures: The Yale–Brown Obsessive–Compulsive Scale Modified for Pathological Gambling (PG-YBOCS), a clinician-administered scale used to assess symptom severity over the past seven days (Pallanti et al., 2005); the Gambling Symptom Assessment Scale (G-SAS; Kim et al., 2009), a self-report measure of gambling severity for the previous week; and the Clinical Global Impression—Severity scale (CGI; Guy, 1976), a 7-item Likert Scale assessing clinical severity.

Subjects' mood and anxiety symptoms were assessed using the Hamilton Depression Rating Scale (HAM-D; Hamilton, 1960) and the Hamilton Anxiety Rating Scale (HAM-A; Hamilton, 1959). Psychosocial functioning was examined with the Sheehan Disability Scale (Sheehan, 1983).

2.3. Cognitive assessments

Subjects underwent two computerized cognitive paradigms from the Cambridge Neuropsychological Test Automated Battery (CANTABeclipse, version 3, Cambridge Cognition Ltd, UK) quantifying aspects of motor impulse control and cognitive flexibility. We focused on these two tests given that dysfunction in the cognitive domains they quantify are potentially dissociable and have been implicated in gambling across multiple studies. Patient testing took place at baseline prior to initiation of any new treatment (placebo or active). Healthy controls were tested in the same environment using the same equipment and same researchers.

The Stop Signal Task (SST) quantifies the ability of participants to suppress already-initiated motor responses (Aron et al., 2004; Logan et al., 1984). On this task, subjects observe a series of directional