Journal of Affective Disorders 226 (2018) 261–266

Contents lists available at ScienceDirect

Journal of Affective Disorders

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

Research paper

Decision making under risk and under ambiguity in depressed suicide attempters, depressed non-attempters and healthy controls

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ARTICLE INFO

Keywords:
Decision making
Iowa Gambling Task
Game of Dice Task
Depression
Suicide attempt

ABSTRACT

Background: A number of neuropsychological alterations have been found in patients who have attempted suicide. Most studies investigating decision making (DM) abilities in suicide attempters so far have used one single DM task and included patients with a lifetime history of suicide attempts. These studies have yielded conflicting results.

Method: In this study, currently depressed in-patients who had a recent suicide attempt (within the last six months) (n = 21), depressed in-patients without a lifetime history of suicide attempts (n = 31) and a healthy control group (n = 26) were assessed with two tasks for the assessment of DM. The Game of Dice Task (GDT) measures DM under risk and the Iowa Gambling Task (IGT) DM under ambiguity. Further, depression severity, impulsiveness and suicidal intent of the current suicide attempt were assessed.

Results: Both depressed groups differed from controls with respect to marital and partnership status, smoking, impulsiveness and psychiatric family history. In terms of DM, IGT scores did not differ significantly between groups. However, suicide attempters made significantly more risky decisions as assessed with the GDT than both control groups ($p < 0.05$ for pairwise comparisons, $p = 0.065$ for overall comparison of the 3 groups).

Limitations: The available tasks assess DM under laboratory conditions which may not reflect the emotional status of suicidal individuals. No general cognitive assessment was included.

Conclusions: Depressed suicide attempters differed with regard to DM under risk but not DM under ambiguity. When studying DM it appears crucial to take varying aspects of DM into account.

1. Introduction

Suicide is the most serious negative outcome of affective disorders and a history of suicide attempts is the most important risk factor for completed suicide (Hawton and Van Heeringen, 2009; Wasserman et al., 2012; Leadholm et al., 2014; Coryell et al., 2016). A number of neuropsychological alterations have been found in patients who had attempted suicide either recently or over their lifetime. These include impaired memory, decreased verbal fluency, lower problem-solving abilities, cognitive inhibition and reduced emotion recognition (Jollant et al., 2011; Richard-Devantoy et al., 2012, 2013; Keilp et al., 2013; Shelef et al., 2014).

Decision making (DM) can be defined as the cognitive process to identify and choose the best of the available solutions regarding a given problem or a challenging situation according to the values and preferences of the decision maker. Situations calling for decisions vary greatly regarding the type and amount of information they offer. In decisions under risk, probabilities of different outcomes, possible gains and possible losses are given or can be calculated whereas in decisions under ambiguity important information is missing or conflicting (Hsu et al., 2005; Brand et al., 2006, 2007). Several tasks have been used to examine these two types of DM. Among them, the Game of Dice Task (GDT) for DM under risk and the Iowa Gambling Task (IGT) for DM under ambiguity are well established and widely applied.

DM has been found to be impaired in a variety of psychiatric disorders including obsessive-compulsive disorder (Dittrich and Johansen, 2013; Pushkarskaya et al., 2015), eating disorders (Wu et al., 2016) and schizophrenia (Fond et al., 2013), whereas panic disorder without comorbid depression seemingly does not reduce DM abilities (Kaplan et al., 2006). Further, patients with Korsakoff's syndrome (Brand et al., 2005a) as well as pathological gamblers (Brand et al., 2005b) show a higher number of risky decisions than healthy control groups.

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http://dx.doi.org/10.1016/j.jad.2017.10.012
Received 21 December 2016; Received in revised form 14 September 2017; Accepted 1 October 2017
Available online 03 October 2017
0165-0327/

With regard to depression, studies on DM under ambiguity performed with the IGT demonstrate conflicting results. Thames et al. (2012) reported a deteriorating effect of depressive symptoms on gambling task performance and Must et al. (2006) found that depressive patients scored lower on the IGT than a healthy control group. In contrast, Smoski et al. (2008) reported better task results in the depressive group compared with a control group. Byrne et al. (2016) suggested a moderating effect of the striatal dopamine D_2 receptor availability on depressive symptoms as an explanation for the inconsistent results.

Concerning suicidality, DM study results are conflicting as well. The majority of studies used the IGT, thus focusing exclusively on DM under ambiguity. Jollant et al. (2005) found patients with a history of suicide attempts to perform worse than healthy controls. On the other hand, Gorlyn et al. (2013) failed to find a general difference in IGT performance between depressed patients with and without a history of suicide attempts and healthy volunteers. Studying female borderline personality disorder patients, LeGris et al. (2012) also found no association between DM and suicide risk. The Cambridge Gamble Task, an instrument which was developed to assess DM and risk taking behaviour outside a learning context, was applied in other investigations which found an association of impaired task performance with suicidal ideation or behaviour (Clark et al., 2011; Chamberlain et al., 2013; Ackerman et al., 2015). In a study using the Effort-Cost Computational Task (ECCT) which tests the impact of reward value on DM, depressed adolescent suicide attempters were less likely to pursue the difficult, high value option than suicide ideators (Auerbach et al., 2015). A recent study investigating DM in a social context found that the facial emotional expression of a virtual partner impacted the monetary outcomes in patients with a history of suicide attempts (Sánchez-Loyo et al., 2016).

Studies conducted so far have used one single instrument to assess DM behaviour. Moreover, for the definition of suicide attempters a lifetime history of attempts was usually applied. In the present study, we investigated DM under risk as well as DM under ambiguity by using the IGT and the GDT in a group of depressed patients with a recent suicide attempt in comparison with currently depressed patients without a suicide attempt history and a healthy control group. We hypothesized that, given the dissociation between DM under ambiguity and DM under risk in other disorders (Kim et al., 2015; Trotzke et al., 2015), task results might differ in suicide attempters, too. In view of the potentially life-threatening outcome of suicidal behaviour, it was expected that suicide attempters would show a tendency for risky decisions.

2. Methods

2.1. Participants

The study sample consisted of three groups. Group 1 (SA) were currently depressed in-patients (ICD-10: F3 or F43) who had attempted suicide within the last six months. Group 2 (NSA) consisted of depressed in-patients without a lifetime history of suicide attempts. Group 3 (CG) was a healthy control group. All participants were at least 18 years old and had to be able to understand and perform the study tasks (i.e., be fluent in German and without severe cognitive impairment).

The SA and NSA groups were recruited at the Department of Psychiatry, Psychotherapy and Psychosomatics of the Medical University of Innsbruck, Austria. Participants of the control group were recruited among hospital staff and their relatives and friends.

2.2. Procedure and general measurements

The study procedure was approved by the Ethics Committee of the Medical University of Innsbruck. After providing written informed consent each participant was tested in one single session which generally lasted about one hour. Sociodemographic data and clinical variables were assessed by one of the two raters. Depression severity was measured using the Beck Depression Inventory (BDI; Beck et al., 1961). Impulsiveness was rated with the Barratt Impulsiveness Scale (BIS; Barratt, 1965). In the SA group suicidal intent of the current suicide attempt was measured using the Suicide Intent Scale (SIS; Beck et al., 1986).

2.3. Game of Dice Task (GDT)

DM under risk was measured with the GDT (Brand et al., 2005a). The GDT is a computer-based gambling task. The participants' goal in the GDT is to maximize the fictitious starting capital of €1000 within 18 throws of a single virtual die. Individuals have to guess which number will appear in the next throw. They can choose a single number or a combination of two, three, or four numbers. The alternatives are associated with a defined amount of money: €1000 gain/loss for the choice of a single number, €500 gain/loss for two numbers, €200 gain/loss for three numbers and €100 gain/loss for four numbers. The winning probability is 16.67% for the choice of a single number, 33.33% for the combination of two numbers, 50% for the combination of three numbers and 66.67% for the combination of four numbers. The first two alternatives (one number or combination of two numbers) are considered as disadvantageous, risky choices, the third alternative (combination of three numbers) is neutral and the fourth alternative (combination of four numbers) is advantageous. Before starting the task, the rules for winning and losing are explicitly explained. The possible gains and losses are constantly shown on the screen. Participants get feedback after each trial and see their current balance on the screen. Outcome measures include the number of risky choices (alternative 1 and 2), the number of non-risky choices (alternative 3 and 4) and the net score (difference non-risky minus risky choices). The latter score was applied in this study.

2.4. Iowa Gambling Task (IGT)

DM under ambiguity was assessed using the IGT. Participants completed the computerized version of the IGT consisting of four decks of cards labelled A, B, C and D (Bechara et al., 2000; for a comprehensive review see Dunn et al., 2006). The participants make 100 card selections. After each selection, a specified amount of facsimile money is awarded. Selecting a card from decks A and B results in large gains of money which are sometimes followed by a large loss. Decks A and B are disadvantageous in the long run. Selecting a card from decks C and D produces small immediate gains. The unpredictable losses are also small, so that these decks are advantageous in the long run. After each card selection, the computer generates a sound indicating gain or loss and a message is displayed on the screen indicating the amount of money the participant has won or lost. On the top of the computer screen, a bar indicates wins and losses and changes according to the amount of money won or lost after each selection. Participants are told that the aim of the game is to win as much money as possible. They are also instructed that some decks are better than others and that they have to avoid the bad decks (for exact and detailed instructions see Bechara et al., 2000). The net score of favourable minus less favourable choices, calculated for each of 5 blocks consisting of 20 choices, is used for analysis. As there appears to be a learning effect during IGT performance it has been argued that the latter blocks may assess, to a certain degree, also DM under risk (Brand et al., 2007).

2.5. Statistical analyses

Comparison of the three groups (SA, NSA, CG) with regard to sociodemographic and clinical variables was performed by means of one-way analysis of variance, Kruskal-Wallis test and Chi-square test, depending on the variable type (normally distributed, non-normally