The Effects of Cognitive Impulsivity on the Duration of Remission in Alcohol-Dependent Patients

Влияние когнитивной импульсивности у больных алкогольной зависимостью на продолжительность ремиссии

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Original research

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ABSTRACT

BACKGROUND: Cognitive impulsivity manifesting in impaired inhibitory control and decision-making impulsivity is observed both in alcohol-dependent and substance-dependent individuals and may affect the ability to maintain long-term (persistent) remission.

AIM: To evaluate the effects of cognitive parameters of impulsivity on the duration of remission in alcohol-dependent patients.

METHODS: The study included 83 patients with alcohol dependence and 51 mentally healthy study subjects as the control group. The distribution of patients by duration of remission was based on the DSM-5 criteria. Patients were divided into two groups according to the duration of their most recent remission: patients with early remission (n=48) and patients with sustained remission (n=35). Impulsivity was assessed using the Go/No-Go task, which included a response inhibition component (inhibitory control). Choice impulsivity was assessed using two cognitive tests that encompass its separate components: decision-making under risk (Cambridge Gambling Task, CGT), and decision making under uncertainty (Iowa Gambling Task, IGT).

RESULTS: The study groups (patients and the controls) differed significantly in all domains of impulsivity: decision making under risk [GT: decision making quality (H(2, N=134)=30.233, p <0.001) and decision-making time (H(2, N=134)=18.433, p <0.001)] and decision making under uncertainty [IGT: selecting cards from "losing" decks (H(2, N=134)=9.291, p=0.009)]. The group of patients with sustained alcohol remission was characterized by longer decision times in CGT compared to the group of patients with early remission (z=2.398, p=0.049). Decision quality in CGT (z=0.673, p=0.999) and IGT scores (z=1.202, p=0.687) were not statistically significantly different between the groups of patients with sustained and early remission from alcohol dependence. The assessment of impulsive actions showed that the study groups were significantly different in terms of their ability to suppress their dominant behavioral response when performing the GNG task [false presses when seeing the "No-Go" signal (H(2, N=134)=28.851, p <0.001)]. The group of patients in sustained remission from alcohol dependence was characterized by better suppression of the behavioral response to the "No-Go" signal relative to the patients in early remission [H(2, N=134)=2.743, p=0.044)]. The regression analysis showed that the decision-making quality (t=2.507, p=0.049) and decision-making time (t=3.237, p=0.031) and the number of false presses when seeing the "No-Go" signal in the GNC task had a statistically significant impact on the duration of remission (t=3.091, p=0.043).

CONCLUSION: The results of this study indicate that impaired decision-making processes and the ability to inhibit the dominant behavioral response have a significant impact on the ability of alcohol-dependent patients to maintain long-term remission.

АННОТАЦИЯ

ВВЕДЕНИЕ: Когнитивная импульсивность, проявляющаяся в импульсивности принятия решений и нарушении ингибиторного контроля, отмечается как у лиц, склонных к злоупотреблению алкоголем, так и у больных с зависимостью от алкоголя и других психоактивных веществ, и может влиять на способность поддерживать длительную (стойкую) ремиссию.

ЦЕЛЬ: Оценить влияние когнитивных показателей импульсивности на продолжительность ремиссии больных алкогольной зависимостью.

МЕТОДЫ: В исследовании приняли участие 83 пациента с алкогольной зависимостью и 51 психически здоровый испытуемый в качестве группы контроля. Распределение пациентов по длительности ремиссии было основано на критериях DSM-5. Пациенты были разделены на две группы в зависимости от длительности последней ремиссии: пациенты с неустойчивой ремиссией (n=48) и пациенты с устойчивой ремиссией (n=35). Импульсивное действие оценивалось с помощью задачи Go/No-Go, которая охватывает компонент торможения реакции (ингибиторный контроль). Оценка импульсивности выбора проводилась с помощью двух когнитивных тестов, которые охватывают ее отдельные компоненты: принятие решений в условиях риска (Кембриджская игровая задача, CGT), и принятие решений в условиях неопределенности (игровая задача Айова, IGT).

РЕЗУЛЬТАТЫ: Исследуемые группы (пациенты и контроль) имели значительные различия по всем доменам импульсивного выбора: принятие решений в условиях риска [CGT: качество принятия решений (H(2, N=134)=30,233, p <0,001) и время принятия решений (H(2, N=134)=18,433, p <0,001)] и принятие решений в условиях неопределенности [IGT: выбор карт из «проигрышных» колод (H(2, N=134)=9,291, p=0,009)]. Группа пациентов с устойчивой алкогольной ремиссией характеризовалась большим временем принятия решений в CGT по сравнению с группой пациентов с неустойчивой ремиссией (z=2,398, p=0,049). Качество принятия решений в CGT (z=0,673, p=0,999) и результаты IGT (z=1,202, p=0,687) между группами пациентов с устойчивой и неустойчивой алкогольной ремиссией статистически значимо не различались. При оценке импульсивного действия обнаружено, что исследуемые группы значительно различались по своей способности подавлять доминирующую поведенческую реакцию при выполнении задачи GNG [ложные нажатия при сигнале «No-Go» (H(2, N=134)=28,851, p <0,001)]. Группа пациентов с устойчивой алкогольной ремиссией характеризовалась лучшим подавлением поведенческой реакции на сигнал «No-Go» относительно пациентов с неустойчивой ремиссией [H(2, N=134)=2,743, p=0,044]. Результаты регрессионного анализа показали, что качество принятия решений (t=2,507, p=0,049), время принятия решений (t=3,237, p=0,031) и количество ложных нажатий при появлении сигнала «No-Go» в задаче GNG оказывали статистически значимое влияние на продолжительность ремиссии у пациентов (t=3,091, p=0,043).

ЗАКЛЮЧЕНИЕ: Результаты исследования показывают, что нарушение процессов принятия решений и способности подавлять доминирующую поведенческую реакцию оказывают существенное влияние на способность больных алкоголизмом поддерживать длительную ремиссию.

Key words: *decision making; response inhibition; alcohol dependence; remission*
Ключевые слова: *принятие решений; торможение реакции; алкогольная зависимость; ремиссия*

INTRODUCTION

Alcohol dependence is a chronic, often relapsing psychiatric disorder associated with specific changes in brain function [1, 2]. An imbalance between reward-related decision-making and executive control processes is thought to be the key component of addiction [3]. Impaired inhibitory control, as one of the most important domains of executive functioning, and decision-making impulsivity are observed both in alcohol-dependent and substance-dependent individuals [4–6] and may affect the ability to maintain long-term (persistent) remission [6, 7].

Cognitive impulsivity is a complex and multilevel process that is associated with a willingness to make quick, ill-considered choices and involves a reduced willingness to tolerate delay in satisfying a desire. Cognitive impulsivity implies the presence of difficulties related to self-control in choosing out of two or more alternative options [8]. Thus, a cognitive impulsivity model includes two domains: impulsive choice and impulsive action.

Impulsive choice is driven by impulsive decision-making related to rewards, high risk, and a preference for smaller immediate rewards over larger but delayed rewards [9]. To assess the choice impulsivity, computerized gambling tasks are used, such as the Iowa Gambling Task (IGT) [10], which evaluates decision-making under uncertainty, and the Cambridge Gambling Task (CGT) [11], which evaluates decision-making under risk. Evidence suggests that although impulsive choice tasks measure time-anchored decision-making ability, different tasks include different domains of the cognitive function [12].

Impulsive action is associated with deficits in the inhibition of the rapid response to a stimulus [13]. It is typically measured using Stop-Signal Tasks (SST) [14], which involve the cancellation of an already initiated motor response (i.e., action cancelation), and/or a Go/No-Go (GNG) task [15], which requires the suppression of a dominant behavioral response (i.e., action inhibition). Most of the known studies have used the SST and GNG tasks as interchangeable alternatives that measure the same latent process (i.e., response inhibition).

Impulsive choice and impulsive action are among the most prominent and common cognitive impairments in alcohol-dependent individuals. Multiple studies show that alcohol dependence is characterized by inhibitory control deficits [16, 17] and an impaired decision-making ability [18, 19]. In addition, cognitive impairment is often associated with poor treatment outcomes [6, 17, 20].

Study hypothesis: based on the above, we hypothesize that cognitive impulsivity may hinder the achievement of long-term (persistent) therapeutic remission in patients with alcohol dependence.

The aim of the study is to evaluate the effects of cognitive parameters of impulsivity on the duration of remission in alcohol-dependent patients.

METHODS

Study design

This is an observational cross-sectional naturalistic study.

Ethical approval

The study was conducted in compliance with the principles of the 1964 Declaration of Helsinki as amended between 1975 and 2013 and was approved by the local Bioethics Committee at the Mental Health Research Institute of the Tomsk National Research Medical Center of the Russian Academy of Sciences. All study subjects, as well as individuals from the control group, gave their written informed consent for participation in the study and the processing of their personal data.

Participants

Patients were selected from the 24-hour inpatient clinic of the Mental Health Research Institute of the Tomsk National Research Medical Center of the Russian Academy of Sciences. The study included 83 patients: 66 males and 17 females (median age and interquartile range Me [Q1; Q3]=45 [40; 52] years) with the following clinical diagnosis: mental and behavioral disorders due to the abuse of alcohol and dependence syndrome (F10.2 according to ICD-10 criteria). The study (interviewing) of the patients was conducted on days 3–5 after hospital admission (for the purpose of management of alcohol withdrawal syndrome, psychological interventions, and rehabilitation) after detoxification.

Inclusion criteria: a diagnosis of alcohol dependence according to ICD-10, voluntary consent to participate in the study, and age of 20–60 years.

Exclusion criteria: refusal to participate in the study, dementia, mental retardation, head injuries with loss of consciousness for more than 30 minutes, and use of drugs affecting impulsivity (i.e., antipsychotics, antidepressants, benzodiazepines).

The diagnosis of the current mental state was made by psychiatrists using the clinical method and the ICD-10

diagnostic criteria. In addition, a questionnaire specially designed for this study was used. It included information on the age of the first alcohol try, the age of the beginning of alcohol abuse, the number of hospitalizations in drug addiction facilities, the duration of the disease, and the duration of the last intermission.

Also, the following socio-demographic information was collected: age, gender, and level of education.

Patients were divided into two groups: with a history of sustained and early remission from alcohol dependence prior to the current exacerbation of the disease. The attribution of patients to groups by duration of remission was based on the DSM-5 criteria. In the DSM-5 (2013), there is a "Alcohol use disorder" class that includes early remission, when no evidence of alcohol use is noted for at least 3 months (but less than 12 months) and sustained remission with no evidence of the disorder for 12 months or longer [21].

The control group included 51 mentally healthy subjects (37 males and 14 females aged Me [Q1; Q3]=43 [39; 49] years). Subjects were recruited from among the staff of the Tomsk National Research Medical Center of the RAS (researchers, physicians, nurses, administrative staff, auxiliary personnel).

Inclusion criteria: voluntary consent to participate in the study and age of 20–60 years.

Exclusion criteria: refusal to participate in the study, dementia, mental retardation, head injuries with loss of consciousness for more than 30 minutes, and use of drugs affecting impulsivity (i.e., antipsychotics, antidepressants, benzodiazepines). To assess alcohol use, all participants in the control group were asked to complete the Alcohol Use Disorders Identification Test (AUDIT) scale in the Russian-language adaptation of the scale (RUS-AUDIT) [22]. The sum of AUDIT scores in the control group ranged from 0 to 7, corresponding to a low level of risk for problems due to alcohol use. Additionally, the subjects in the control group were examined by psychiatrists; history of mental illnesses and somatic disorders, as well as socio-demographic data (age, gender, education level), was collected.

All subjects from the patient and control groups were assessed for impulsive actions and impulsive choices.

Methods of impulsive action assessment

Impulsivity was assessed using a neurocognitive GNG task [23], which included a response inhibition component (i.e. automatic inhibition or inhibitory control).

A GNG task is a computer-based assessment of response suppression. In this version of the test, subjects were asked to press a button when a green oval appeared on the screen "Go" and not to press it when a red oval appeared "No-Go". Stimuli (ovals) were presented in random order. The stimulus presentation time was 500 ms, and the inter-stimulus interval was 800 ms. There were 60 stimuli in total: 30 were "Go" and 30 were "No-Go". The output data included the number of errors — false presses when seeing the "No-Go" signal reflecting an incorrect response to a nontarget stimulus as a primary indicator of response disinhibition and impulsive action.

Methods of impulsive choice assessment

Choice impulsivity was assessed using two cognitive tests that encompass its separate components: decision-making under risk and decision-making under uncertainty.

The Cambridge Gambling Task [24] is a computerized test that allows one to evaluate various aspects of the decision-making process under risk. In this version of the test, subjects had to guess whether the token was hidden in the red or blue boxes (there were 10 boxes in total, and the red and blue boxes could be represented in various ratios from 5:5 to 9:1) and then bet (from a set of four predetermined amounts: 5, 25, 50, or 75 points) on the accuracy of their decision. If the guess was correct, the subject was credited with the selected number of points; if incorrect, that number of points was deducted. The subjects had a total of 10 attempts. During the test, the quality of decision-making (percentage of logically correct answers based on the ratio of red and blue boxes) and average decision-making time in seconds were analyzed.

The Iowa Gambling Task [25] is a psychological task aimed at assessing decision making based on emotional learning under uncertainty. In the IGT version used, the participant is asked to choose cards from any deck out of four decks on the screen. Two decks contain high-risk cards. They give high points (100 points each) but also rare large penalties (250 to 500 points), the result is losing in the long run when choosing predominantly these cards. The other two decks give small points (50 points each), but also small penalties (50 points each), resulting in a win in the long term if you choose predominantly these cards. The analysis of the results of performing this task included the number of selected cards from "high" risk ("losing") decks out of 100 possible choices.

Statistical analysis

Statistical analysis was performed using the Statistica 12 software package (StatSoft). The minimum sample size was determined using the method of K.A. Otdelnova [26] for a significance level of p=0.05. The normal distribution of data was verified using the Shapiro-Wilk test. The obtained data were not normally distributed. Qualitative data are presented by frequency parameters in absolute and relative units, *n* (%). Quantitative variables are presented as a median and interquartile range Me [Q1; Q3]. The subjects were divided into three groups for statistical data analysis: a group of patients with alcohol dependence and early remission; a group of patients with alcohol dependence and sustained remission; and a control group. The Kruskall-Wallis (ANOVA) with Dunn's test for *a posteriori* pairwise comparison procedure was used to assess differences between all three groups in terms of sociodemographic parameters and cognitive test scores. The Mann-Whitney test was used to compare clinical data between the two patient groups. The χ^2 test was used to compare frequencies. We also conducted a linear regression analysis to assess the effect of selected quantitative measures of cognitive impulsivity on the remission duration in alcohol-dependent patients. The differences were considered statistically significant at p <0.05.

RESULTS

Sample description

A total of 134 subjects were enrolled in the study. The control group included 51 healthy volunteers. Patients with alcohol dependence were divided into two groups depending on the duration of their last remission (before this hospital admission) according to DSM-5 criteria. The group of patients with early remission (3 to 12 months of abstinence from alcohol) included 48 patients with a duration of remission Me [Q1; Q3]=6 [3; 10] months. The group of patients with sustained remission (more than 12 months of abstinence from alcohol) included 35 patients with a duration of remission Me [Q1; Q3]=30 [18; 60] months. The patient and control groups were well balanced in terms of sociodemographic variables (Table 1). There were no differences that were statistically significant in terms of age [H(2, N=134)=3.717, p=0.155], sex [χ^2(2, N=134)=0.871, p=0.647], or education level [χ^2(4, N=134)=2.972, p=0.562].

The Table 2 shows the analysis of differences in alcohol consumption characteristics between patients with alcohol dependence with early and sustained remission revealed significant intergroup differences only in terms of the duration of remission (U=1861, p <0.001).

Table 1. Sociodemographic characteristics of the sample

Parameter		Control (*n*=51)	Alcohol-dependent patients with early remission (*n*=48)	Alcohol-dependent patients with sustained remission (*n*=35)
Age (years), Me [Q1; Q3]		43 [39; 49]	45 [39; 52]	47 [43; 51]
Sex, *n* (%) male		37 (72.5%)	38 (79.2%)	28 (80%)
Education level, *n* (%)	Higher education	33 (64.7%)	23 (47.9%)	19 (54.3%)
	College education	11 (21.6%)	15 (31.3%)	9 (25.7%)
	High school	7 (13.7%)	10 (20.8%)	7 (20%)

Table 2. Differences in the characteristics of alcohol use among groups of patients with different remission types

Parameter	Alcohol-dependent patients with early remission (*n*=48)	Alcohol-dependent patients with sustained remission (*n*=35)	U	*p*
Age of the first try of alcohol (years)	16 [15; 18]	16 [16; 17]	531	0.984
Age of the start of alcohol abuse (years)	25 [20; 35]	26 [22; 35]	514	0.813
Number of hospitalizations	2 [1; 4]	2 [2; 3]	799	0.999
Duration of the disease (years)	17 [11; 21]	18 [12; 24]	652	0.183
Duration of the last remission (months)	6 [3; 10]	30 [18; 60]	1861	<0.001

Table 3. Intergroup differences in terms of impulsive choice parameters and impulsive actions

Parameter		Control (*n*=51)	Alcohol-dependent patients with early remission (*n*=48)	Alcohol-dependent patients with sustained remission (*n*=35)	H	*p*
Cambridge Gambling Task	Decision-making quality (%)	90 [80; 100]	60 [50; 70]	60 [50; 80]	30.233	<0.001
	Decision-making time (s)	3 [2.8; 3.3]	3.5 [2.8; 4.6]	4.4 [3.6; 5.3]	18.433	<0.001
Selection of cards from "losing" decks in the Iowa Gambling Task (*n*)		48 [40; 55]	53 [51; 61]	55 [52; 63]	9.291	0.009
Go/No-Go task	False presses when seeing the "No-Go" signal (*n*)	0 [0; 1]	3 [2; 4]	2 [1; 3]	28.851	<0.001

Choice impulsivity and impulsive actions in the study group

The statistical data analysis between the patient and control groups in choice impulsivity assessment tasks (CGT, IGT) showed that the study groups differed significantly in all impulsive choice domains (Table 3). An additional *post hoc* analysis (Dunn's test) for pairwise comparisons showed that all study groups compared with each other. It was revealed that the control group, compared with patients with sustained remission, was characterized by better decision-making, both under risk (CGT), quality of decision-making (z=3.882, p <0.001), and decision-making time (z=4.281, p <0.001), and under uncertainty (IGT): choosing cards from "losing" decks (z=2.953, p=0.009). At the same time, when comparing the control group with patients with early remission, statistically significant differences were revealed in the CGT only in terms of decision-making quality (z=5.038, p <0.001) and the IGT [choosing cards from "losing" decks (z=2.085, p=0.018)]. The comparison between the decision-making time in the CGT for the control group and the patients with early remission showed no statistically significant differences (z=1.941, p=0.156).

The group of patients with sustained remission from alcohol dependence was characterized by longer decision-making times in the CGT compared to the group of patients with early remission (z=2.398, p=0.049). The comparison of the decision-making quality in the CGT (z=0.673, p=0.999) and choosing cards from "losing" decks in the IGT (z=1.202, p=0.687) between the groups of patients with sustained and early remission from alcohol dependence showed no statistically significant differences.

The assessment of intergroup differences in the impulsive action task (GNG task) also showed that the study groups were significantly different in terms of their ability to suppress the dominant behavioral response (pressing the button falsely at the "No-Go" signal). A *post hoc* analysis using the Dunn's test showed that the control group had better suppression of their behavioral response to the "No-Go" signal compared with both groups of patients [when compared with the group of patients with sustained remission (z=4.111, p <0.001), and when compared with the group of patients with early remission (z=4.297, p <0.001), respectively].

On the other hand, the group of patients with sustained remission from alcohol dependence displayed better suppression of their behavioral response to the "No-Go" signal relative to the patients in early remission (z=2.743, p=0.044).

Assessment of the effects of different parameters of cognitive impulsivity on the duration of remission in alcohol-dependent patients

To determine the effects of various domains of cognitive impulsivity on the duration of remission in alcohol-dependent patients, a series of separate regressions were performed, where the choice impulsivity parameters were used as independent variables: (1) decision-making under risk (CGT: decision quality, decision time); (2) decision-making under uncertainty (IGT: the number of cards selected from the "high" risk decks) and impulsive action; and (3) the ability to successfully suppress a dominant behavioral response in a GNG task.

The first model obtained based on decision-making under risk (CGT) turned out to be statistically significant [F (2.42)=4.999, p=0.031]. R^2=0.331, indicating that decision-making quality and decision-making time explained approximately 33% of the variability in remission duration. The predictors of remission duration were statistically

significant: both decision-making quality (t=2.507, p=0.049), and decision-making time (t=3.237, p=0.031). The equation is as follows: remission duration = 0.191 × decision-making quality + 6.155 × decision-making time − 10.558.

The second model based on decision-making under uncertainty (IGT) was found to be statistically insignificant [F(1.43)=0.479, p=0.492]. R^2=0.011, which indicates that the number of selected cards from "high" decks in the IGT explains only about 1% of the variability in the duration of remission. The number of cards selected from "high" risk decks in the IGT did not significantly affect the duration of remission (t=0.692, p=0.492). The equation is as follows: duration of remission = 10.858 + 0.202 × number of selected cards from "high" risk decks.

Finally, the third model, which used the ability to successfully inhibit the dominant behavioral response as a predictor, was statistically significant [F(1.81)=4.315, p=0.043]. R^2=0.271, indicating that the number of false presses when seeing the "No-Go" signal in the GNG task was associated with approximately 27% of the variability in remission duration. The number of false presses when seeing the "No-Go" signal in the GNG task had a statistically significant impact on the duration of remission (t=3.091, p=0.043). The equation is as follows: remission duration = 17.491 − 1.285 × number of false presses when seeing the "No-Go" signal.

DISCUSSION

The goal of this study was to evaluate the effects of the cognitive parameters of impulsivity on the duration of remission in alcohol-dependent patients. The study showed that decision-making under risk (decision-making quality and time) and the ability to successfully suppress the dominant behavioral response influenced the duration of remission in alcohol-dependent patients.

The effects of impulsive choice on the duration of remission

The evaluation of choice impulsivity showed that longer remission was associated with better decision-making under risk; however, decision-making under uncertainty did not affect the duration of remission. These results suggest that the tendency to make choices prematurely (decision-making time) and irrationally (decision-making quality) without anticipating possible negative consequences may serve as a factor of disruption in alcohol-dependent patients. The obtained data are consistent with previous studies that reported a similar trend in samples of alcohol-dependent patients with early and long-term remission [27, 28].

The obtained data also showed that both groups of patients with alcohol dependence demonstrated poor decision-making under both risk and uncertainty compared with participants from the control group. These results are consistent with previous studies and support the assumption that the decision-making process is impaired in alcohol dependent patients [6, 29]. In addition, there were intergroup differences in decision-making under risk between patients with sustained and early remission: patients with early remission from alcohol dependence had shorter decision-making time; i.e., they tended to make a choice prematurely.

Thus, the results of the study indicate that there is an association between impulsive choice and the duration of remission in alcohol-dependent patients. This is consistent with the results of neuroimaging tests demonstrating persistent structural and functional abnormalities of the orbitofrontal cortex and function in various types of addiction involved in impulsive choice tasks [30, 31]. These studies also show that long-term toxic exposure to a variety of psychoactive substances (including alcohol) leads to changes in brain functioning that may underlie the maladaptive behaviors and disadvantageous decisions that characterize the daily lives of people with alcohol dependence. However, impaired decision-making can also be seen as a risk factor that may explain the tendency of substance users to continue their behavior despite negative long-term consequences. In this context, the differences in decision-making under risk (decision time) between patients with sustained and early remission from alcohol dependence in this study may reflect the stable premorbid cognitive characteristics of people who are able to successfully maintain long remission. Accordingly, patients who are able to abstain from alcohol for extended periods of time may be characterized by an unchanged or more adaptive decision-making process, which in turn may explain their ability to successfully maintain long-term abstinence.

The effects of impulsive action on the duration of remission

The results obtained in the area of impulsive actions indicate that regardless of the duration of remission, alcohol-dependent patients showed a reduced ability to

inhibit their dominant motor response (i.e., the dominant behavioral response) compared to the control group.

The observed differences in the effectiveness of motor response suppression between members of the control group and alcohol-dependent patients are consistent with other studies [32, 33]. It is also important to note that according to the regression analysis, the ability to suppress the dominant behavioral response is a factor that influences the duration of remission. Thus, the results of the study indicate that there is an association between impulsive choice and the duration of remission in alcohol-dependent patients.

The observed differences in the GNG task success between groups of patients with different durations of remission from alcohol dependence may also reflect premorbid cognitive features underlying their ability to maintain long-term abstinence from alcohol.

Strengths and limitations

The main strength and main practical result of this study is the demonstration of significant relationships between cognitive impulsivity parameters and the duration of remission in alcohol-dependent patients. The study results emphasize the potential impact of impulsive choices and impulsive actions on patients' ability to maintain long-term (persistent) remission. Further study of the cognitive domains of impulsivity in relation to clinical-dynamic variables offers hope for the development of more personalized and person-centered approaches in the psychiatric rehabilitation of individuals with alcohol dependence.

The present study has a number of limitations that need to be considered when interpreting the data. First, the patients' acute condition after heavy drinking could affect the results of cognitive tests. This, in turn, could lead to asthenia, more formal task performance, which could ultimately result in their being different from the control group. Second, this study did not take into account additional cognitive and affective processes that could have influenced or mediated the impulsive choices and impulsive actions in alcohol-dependent patients. Future research should include the assessment of additional cognitive functions such as working memory, attention, and the emotional processes known to affect the performance of tasks involving impulsive choices and impulsive actions. Third, a cross-sectional study design limits our knowledge of the effects of the individual neurocognitive aspects of impulsivity on the duration of remission. In addition, the duration of remission was assessed retrospectively (based on the patient's history). Our results may not reflect the potential changes associated with recovery of the decision-making ability and inhibition of reactions during abstinence, but rather reflect the specific premorbid characteristics of individuals who are able to successfully maintain long-term remission. Fourth, this study did not include a comprehensive assessment of the concomitant psychiatric disorders that often co-occur with alcohol dependence, such as mood disorders, anxiety disorders, and personality disorders. Future studies could assess the impact of other psychiatric disorders on cognitive impulsivity in patients with alcohol dependence more thoroughly. Another limitation of this study is the lack of control for the the different therapeutic interventions effects on cognitive impulsivity parameters. Given that most of the patients enrolled in the study had been treated during previous hospitalizations, these treatment programs may have had some impact on their neurocognitive functioning. Therefore, future studies should further investigate the effects of different pharmacologic and non-pharmacologic interventions on selected domains of cognitive impulsivity in patients with different durations of remission. Finally, the group of patients with sustained remission was very heterogeneous in terms of the duration of abstinence: abstinence periods ranged from 12 months to 5 years. Future studies should collect data in relatively more homogeneous groups of patients abstaining from alcohol that reflect different stages of recovery process (e.g., 1–2 years of abstinence, 2–3 years of abstinence, etc.).

CONCLUSION

Thus, the study showed that impaired decision-making processes and the ability to inhibit the dominant behavioral response had a significant impact on the ability of alcohol-dependent patients to maintain long-term remission. Consistent with previous studies, the current findings highlight the growing need to develop new personalized cognitive rehabilitation programs for alcohol-dependent patients at various stages of remission. The development of personalized therapeutic interventions aimed at correcting impaired cognitive functioning, specifically cognitive impulsivity, may have broad practical implications for the rehabilitation of patients with alcohol dependence and may help to address some of the limitations of traditional therapeutic approaches.

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