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Risky decision-making and the intensity of opioid drug dependency in early phase of methadone maintenance protocol

Peyman Hassani-Abharian^{a,b*}, Hossein Tabatabaei-Jafari^{a,b}

^a*Institute for Cognitive Sciences Studies, Tehran, Iran (www.ircss.org)*

^b*Neurocognitive Laboratory, Iranian National Centre for Addiction Studies, Tehran University of Medical Sciences, Tehran, Iran*

Abstract

Several studies show positive effect of MMT on decision-making in substance dependents, but severity of the disorder has been ignored by most of them. This study used Iowa Gambling Task (IGT) to find correlation between severity of the disorders in early phase of MMT and risky decision-making in three groups of subjects (mild, severe, control). The study shows no significant difference among groups in risky decision-making, which might be related to the effect of opioid on cognitive functions independent of the severity of the disorder, and stabilization in MMT can repair deficit in decision making shortly during the early phase.

Keywords: Decision making; IGT, MMT, addiction, opioid drug, intensity of drug dependency;

1. Introduction

Behaviourologically, addiction can be defined as a narrowing of person's goals to pursue the rewards by obtaining, using, and recovering from drugs of abuse, despite undesirable consequences [Hser et al., 2001; McLellan et al., 2000]. It seems activity of the mesolimbic dopaminergic system is associated with the experience or the expectations of reward and therefore plays an important role in the mechanisms underlying reward-seeking behaviour [Berridge 1996; Blackburn et al., 1992; Richardson & Gratton, 1998]. Traditionally, studies on substance use disorders have been focused on the mesolimbic dopaminergic system. But recently, involvement of orbitofrontal cortex in inhibitory decision-making processes, especially in reward-related behaviour, put it in the focus of attention. Orbitofrontal cortex processes the reward value and/or affective valence of environmental stimuli and has a known role in inhibition of inappropriate behaviours, and response inhibition [Bechara & Damasio, 2002; Fan et al., 2003; Krawczyk, 2002; Dom et al., 2005].

Several studies show evidence of significant deficits in decision-making in people with substance use disorders [Dom et al., 2005]. These people are especially prone to impulsive decision-making (risky decision-making) in real life, behaviours that require balancing among rewards, punishment, and risk [Bechara et al., 1994; Bechara et al.,

* Peyman Hassani-Abharian. Tel: +98 912 175 0782

E-mail address: Hasani_p@ircss.org, abharian1972@yahoo.com

1997; Bechara et al., 2000b; Rogers et al., 1999b; Sanfey et al., 2003; Fellows & Farah, 2005]. The studies compared decision-making among current drug dependents and dependents that were on Methadone maintenance protocol or Bupernorphine maintenance protocol. The most widely used task in these studies was Iowa gambling task (IGT). Most of the investigations show in tacked risky decision making during Methadone maintenance therapy (MMT), but some of them show reduction in risky decision making during MMT [Ersche Karen et al., 2006; Pirastu et al., 2006; Prosser et al., 2006; Rapeli et al., 2007]. Therefore, still there is controversy about the effect of MMT on decision-making in drug dependents. One possible reason of this discrepancy might be related to the different inclusion criteria, which these studies used for subjects choosing. The severity of the disorder could be the most important one, and there is a gap in the literatures about evaluation of severity of drug dependency and the effect of MMT on decision-making.

In this study we try to assess whether the severity of the disorder has any effect on risky decision-making during the early phase of methadone therapy. We hypothesized that severity of drug dependency has direct effect on risky decision-making during the early phase of methadone maintenance therapy.

2. Material and Methods

Subjects; Twelve otherwise healthy male IV heroin dependents, and thirteen male opium smokers, both groups in their first six-months Methadone maintenance therapy (early phase), who met DSM-IV criteria for opium dependence, were recruited through private clinics for treatment and rehabilitation of drug dependency in Tehran. Control group consist of fifteen healthy male, who did not have any history of drug of abuse and psychiatric disorders in their past psychiatric history. The intensity of dependency defined as harmfulness and danger of drug use, and it is well known that injection of drugs is the most harmful rout of abuse and smoking is the less harmful type of drug abuse. Accordingly, IV heroin dependence was defined as sever form and opium smoking was defined as mild form of addiction.

All participants provided written informed consent. The Research Ethical Committee of the Institute for Cognitive Science Studies (ICSS) approved the study. The subjects were paid for their participations.

Material and Procedure; in the study Iowa Gambling Task (IGT) has been used for measurement of risky decision-making. The Iowa gambling task (IGT) takes the form of a card game in which participants select cards from one of four decks in an effort to win play money. Two of the decks are associated with large wins, but occasional even larger losses. The other two conceal smaller wins, but even smaller losses. Each participants begins with 2000 \$, and it is possible for him to win or loss 2500\$.

A computerized version of the IGT had been used, identical in design to the original task as described by Bechara and his colleagues [Bechara et al., 2000b]. Task instructions were taken from the same source. The task were explained to all participants, and asked them to do their bests. To motivate them a reward equal to 25% of their win in Dollars designed in the study. Subjects played for 100 trials and the main dependent measure for the IGT and its variants were the final numbers of participants.

All groups administered the task in the same order, and acquired data were analyzed by using JMP (version 5.1) software. Levene unequal variances test had done to examine if, there was any significant difference among the standard deviations of the groups. Then one-way ANOVA test had done to determine if, there was a significant difference among three different groups. At last, after emerging two dependent groups, T test underwent to find any significant difference between the new group and the control group. Significant level was set at $p < 0.05$.

3. Results

Participants' age ranged from 20 to 55 years, the average age in IV heroin dependents (sever group) was 30 years, in opium smokers (mild group) was 38 years, and in control group was 37years. Both dependent groups were in their early MMT phase (first 6 months); the average duration of treatment in sever group was 5 months, and in mild group was 4 months. The average duration of addiction in sever group was 7 years, and 9 years in mild group.

The main dependent measure for the IGT and its variants was the final numbers of participants after 100 trials. Each participant began with 2000\$, it was possible for him to win or lose 2500\$, therefore, the theoretical measured mark of every participants could be ranged between -500\$ to 4500\$, but practically the marks more than 3700 or 4000 are impossible. This restriction related to the unpreventable mistakes that participants should perform before calibration. In the study the highest IGT mark was 3650 and the lowest one was 50 and the difference was 3600.

Levene unequal variances test showed no significant difference among standard deviations of the groups (F Ratio; 0.54, D F Num; 2, P Value; 0.59) and one-way ANOVA is possible to do. One-way ANOVA test revealed no significant difference (F Ratio; 1.34, D F Num; 2, P Value; 0.27) in three groups in the final marks. Comparison of merged dependent group and control group showed no significant difference (P Value 0.67) between them.

4. Discussion

In the present study, IGT was used to assess risky decision making in two sever and mild dependent groups who were in their early phase MMT vs. healthy controls. The main dependent measure for the IGT and its variants was the final numbers of participants after 100 trials. The statistical analysis of the data showed insignificant difference in risky decision making between sever and mild dependent groups, which means there is no relationship between intensity of opioid dependency and impairment of decision making. This finding is in agreement with Prosser et al., 2006 who reported no relationship between duration or intensity of opioid abuse and the intensity of cognitive deficits, which were assessed by different neuropsychological testes, and consistent with the findings of Darke et al., 2000, Verdejo et al., 2005, Guerra et al., 1987, and Rounsaville et al., 1981, who all reported absence of an effect of length or amount of drug abuse on neuropsychological measures. However the effect of Methadone treatment on dependent subject is undeniable in consistent with the finding of Prosser et al., 2006 who found that abstinent subjects performed worse than their methadone maintenance counterparts on cognitive evaluations. Therefore this finding shows that MMT might be able to decrease the opioid addictive cognitive deficits.

Another finding of the study was insignificant difference in risky decision making between merged dependent group in their early MMT phase and healthy controls. It means Methadone therapy even after short duration can improve risky decision-making. Dependent participants were in their first 6 months period of treatment, and there was no relationship between duration of treatment and improvement in decision-making. This finding support the previous studies that show Methadone maintenance therapy can improve cognitive functions in opioid dependents [Pirastu et al., 2006]. The positive effect of Methadone on dependents even in short duration may be related to the stabilization which occurs by deleting opioid effect on cognitive functions. Although there are studies, which suggest long term impairment in cognitive function even after long period of Methadone treatment [Ersche Karen et al., 2006; Prosser et al., 2006].

The study had a number of limitations. The first was sample size and the second was mismatch in age, duration of addiction, and duration of MMT. Although statistical methods have been used to compensate these limitations.

In conclusion, risky decision making were find to be similar to healthy people in dependents on MMT in spite of duration of addiction and duration of therapy, and it suggests immediate and good effects of Methadone on risky behaviors in dependent patients and supports the importance of Methadone in harm reduction protocols.

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