

Effects of Methadone Maintenance Treatment in Heroin Addicts on Inhibitory Control: A Longitudinal Observation of fMRI

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Target audience

Researchers interested in the effect of methadone maintenance treatment on heroin craving.

Introduction

Nowadays, there are many studies focus on the effects of methadone maintenance patients (MMP) inhibitory control function according to behaviors. However, using functional magnetic resonance imaging (fMRI) combined with the task to studying methadone maintenance treatment (MMT) is rare. Although it is an agreement that MMT is an effective and safe option for treatment of heroin dependence, there have been controversies about its effect on heroin craving^[1]. Some studies reported that methadone may reduce heroin craving^[2], whereas other studies reported the opposite^[3]. Several factors might be involved in the experience of craving for heroin addicts being maintained on methadone. In this study, we will evaluate the effect of methadone maintenance treatment for heroin addicts on inhibitory control function by analyze the personality, cognitive and neural basis.

Method

Fifteen male former heroin addicts receiving MMT were recruited in this study since 2012 and all participants gave written informed consent. The demographic characteristics of the methadone maintenance patients were listed in Table 1. Each participant carried out the test of Hamilton anxiety scale (HAMA), beck depression rating scale (BDI), protracted withdrawal symptoms scale (PWSS) and barratt impulsiveness scale (BIS). All MR scans were conducted on a 3.0T GE Signa Excite HD MRI scanner with an eight-channel head coil. BOLD functional imaging data with double run GNG (go-nogo task) and high-resolution fast spoiled gradient echo 3D T1-weighted images were acquired, SPM8 was used to processing the functions of data. All of the subjects were reviewed the mentioned projects one year later. All data were analyzed by paired t-test.

Results

There was no significant difference of all subjects of personality rating scale before and after one year, including BDI, HAMA, PWSS, BIS ($p>0.05$). All participants data reflecting the cognition and execute ability of GNG test parameters, including reaction time, Go accuracy and No-Go counterpoint, had no significant differences either after one year ($p>0.05$). Compared with one year before, activation of the brain area enhanced, including bilateral superior temporal gyrus, precentral gyrus, inferior parietal lobule, insula, left postcentral gyrus, cuneus, supramarginal gyrus, lingual, superior frontal gyrus and right inferior frontal gyrus ($p<0.005$, Alphasim correction), as shown in Fig.1. There was no negative activation area. Under the condition of the go-nogo task, activation degree of the left superior temporal gyrus, cuneus and precentral gyrus had negative correlation with total dose use of methadone ($p = 0.003$, $r = -0.654$; $P = 0.008$, $r = -0.588$; $P = 0.002$, $r = -0.5527$).

Discussion and Conclusion

The results of this study show that the heroin dependence withdrawal by the MMT a year later, MMP personality rating scale and inhibitory control function of behavioral indicators were not significantly changed. Nevertheless, inhibitory control function related brain regions reveal significant activated difference before and after one year treatment. And the enhancement degree in relevant regions showed negatively correlated with methadone dosage. MMT plays an important role in heroin dependence patients to maintain heroin withdrawal and methadone plays a negative role in inhibitory control function in heroin addicts. This study demonstrate that the methadone dose should be reduced in MMT but not enough to trigger a relapse.

Reference

- [1] Fareed A et al. J Addict Dis. 2011; 30(1):27-38.
- [2] Barta W et al. J Stud Alcohol Drugs 2009; 70:735-40
- [3] Ilgen M et al. Behav Res Ther 2008; 46:1170-5

Table 1. Demographic characteristics of the methadone maintenance patients.

Characteristics	Mean \pm SD/ Median \pm Q	Range
Age(years)	35.8 \pm 8.0	22-48
Education(years)	9.0 \pm 4.0	6-12
Cigarette lifetime use duration (years)	17.2 \pm 8.2	2-30
Cigarette amount (n/day)	20.0 \pm 5.0	5-45
Cigarette total amount (n)	123840.1 \pm 77947.6	3650-306600
Heroin lifetime use duration (years)	4.2 \pm 12.2	0.5-19
Heroin dosage(g/day)	0.3 \pm 0.25	0.1-2.0
Heroin lifetime total dosage(g)	35531.0 \pm 37507	78-6852
Methadone lifetime use duration (years)	2.3 \pm 1.4	0.3-4.7
Methadone dosage per day(mg/day)	42.2 \pm 1.7	12-80
Methadone lifetime total dosage(mg)	50995.0 \pm 35460.4	9480-162425
Methadone dosage one year(mg)	15189.0 \pm 6000.9	4320-28440

