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The Current Study and Potential Treatment of Drug Abuse

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Abstract. It has been a long time since China started to strictly control drug transaction and usage. There are increasing compulsory detoxification institution, institutions to do voluntary detoxification, and community drug treatment rehabilitation. These detoxification institutions implement medication detoxification, psychological detoxification, and doing moral & physical education, aiming at helping the rehabilitation personnel and reduce the relapse rate after getting treatment in the compulsory detoxification institution. To avoid reoccurrence and suffering from a long-term imprisonment for drug control, biomedical research to improve drug abuse treatment and addiction prevention are in need. This paper is going to summarize the previous and ongoing research on the mechanisms of addiction, together with the approaches of the drug abuse treatment to state some analysis and suggestion about the scientific ways to help drug rehabilitation to find more effective and efficient ways for the treatment of drug abuse to decrease the relapse rate and rehabilitated time.

Keywords: psychosis, methamphetamine, drug abuse, narcotics, neuroscience

1. Introduction

China has restricted narcotics for a long time. From Qing dynasty, China has started to control the transaction and use of narcotic. Since 2008, the new Drug Control Law came into force; by 2019, there are 370 compulsory detoxification institutions in China; more than 1,444,000 drug addicts have got treatment in compulsory detoxification institutions, and 207,000 are currently getting treatment; A total of more than 106,000 drug rehabilitation personnel have been admitted in the recovering institution, and nearly 4000 people are currently on the list; more than 55,000 people were served in community drug treatment rehabilitation [1]. The official relapse rate is not clear, but a previous study showed that the relapse rate of the first year of the people who have got compulsory detoxification is nearly 47.6% [2]. Although the restrictive work of drugs is going on, the cases of drug abuse still occur frequently. Therefore, the researching and analysis about the ways of detoxification is in need. This paper will analyze and compare three different kinds of drugs regarding their symptoms or even lethality, mechanisms on addiction and relapse, and the potential therapies for the affected people.

2. The main symptoms of drugs

A drug might:

Reduce the synthesis of neurotransmitter.
Increase the shortage of neurotransmitter
Block those cleft enzymes that used for metabolizing neurotransmitter.
Block neurotransmitter release and reuptake.

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2.1. Methamphetamine

Methamphetamine (METH) was found in 1893, Japan. It was first extracted in ephedrine. It was used on the soldiers and the workers who had to work for a long a time. Therefore, there were many METH users getting addicted after the WWII. It is a transparent crystal and called 'ice' in China due to its appearance. METH is a high addictive, strong stimulant that affect central nervous system. Someone using the METH might feel excited, awake, energetic, and satisfied [3]. The 'positive' effects to the user once make it sold as an OTC (over the counter) medicine, and therefore induce its epidemic. It also causes some negative influences in social life, such as unemployment, incarceration, etc. It changes the way how brain works and increases the burden of cardiovascular system, therefore, people may also feel loss of appetite, nausea, faster breathing, anxiety, aggressive, hallucinations, and mood disturbance [4]. The high concentration of METH is lethal because it activates the cardiovascular system, which manifests as the increase of the blood pressure and heart rate. The reason why METH can cause the activation of cardiovascular system might be its function of the promotion of releasing norepinephrine from the sympathetic nerve endings [3]. Despite that norepinephrine is used in emergency treatment, it may rapidly exhaust the patient's physical function. Therefore, frequently taking it excessively might cause the overload or failure of the organ functions.

2.2. Lysergic acid diethylamide (LSD)

LSD (commonly called 'acid') is a kind of psychedelic (the drug causing hallucination). It was originally produced with lysergic (a substance found in Claviceps purpurea, a fungus lives on rye plants) in lab [5]. The hallucinate effect of LSD was found in 1943 and became popular for the next decades. Although the research of MTF (Monitoring the Future) shows that the recognition and approval of LSD is decreasing in the teenagers, to ensure that they know about it is still important [5]. Because low recognition can also cause the rebound of the popularization of LSD. Commonly, LSD can produce a psychotic-like state, but it produces real psychosis on the vulnerable subjects (people who have pre-existence risk of mental disease) [6]. It can induce conceptual disorganization, hallucination, delusions, and some early symptoms of schizophrenia. In short, the user can feel some disordered color in their vision, and disorder of space and time, which are common phenomenon of hallucination.

2.3. Heroin

Heroin is a kind of opiate which cause severe addiction [7]. The possible symptom might be euphoria, confusion, social withdrawal, etc. [8]. Heroin also has high tolerance just like the former two drugs, and it has some severe withdrawal symptoms such as nausea, nervousness, depression, shaking, and some severe symptoms like anxiety, impaired breathing, hypertension, etc., which can easily cause the relapse of it. The depression symptom can even cause the motivation of suicide, but it averagely lasts for a week averagely, and fast to be metabolized (for 5-10 days according to The National Highway Traffic Safety Administration of the US (NHTSA)) [9].

3. Mechanisms

3.1. Methamphetamine

When using METH, it can rapidly cause the high concentration of itself in the brain. Subsequently, it stimulates the release of monoamine neurotransmitter from the nerve ending like dopamine, 5-hydroxytryptamine (5-HT), and norepinephrine [3]. The mechanism of the situation that METH makes the dopamine level comparatively lower in the users' brain than the normal people, which is called "neural plasticity", is still uncertain whether it is because that METH causes neuronal loss or not. The way how METH causes the release of neurotransmitter is also not completely understood, but there are some conjecture states. For example, METH affects recombinant vesicular monoamine transporter 2 (VMAT2) and sigma-1 receptor.

In the animal experience, researchers found that METH can also directly interact with dopamine transporters [3]. The dopamine is consumed in the addictive process, and the lower level of dopamine

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of the METH-addictive people might explain why they have difficulties on cognition and feel unpleasant when detoxifying.

3.2. LSD

LSD mainly stimulates and utilize ventral tegmental area (VTA), which is an important brain functional region on the midline of the midbrain [6]. Especially, VTA dopamine neuron is related to the award, motivation, and drug addiction. 5-HT is also active in modulating and stimulating some receptor [10]. Tolerance to LSD develops quickly that the same dose can not cause any reaction on the third day even the patient only used for three continuous days [11]. The users may quickly increase the dosage to a dangerous amount.

3.3. Heroin

The system of opiates is in charge of regulating pain and control the awards, which makes it an effective pain killer [12]. However, it is also addictive. Heroin affects some basic body functions like heart rate, blood pressure, etc. It stimulates the opioid receptors in the brain and helps the release of neurotransmitter and hormone that create pleasant feelings [8]. It is decomposed into morphine when getting into the brain. Subsequently, morphine will modulate the opioid receptors and cause the large-amount secretion of dopamine. The high tolerance might be caused by the decreasing reaction of the opioid receptors to the drug [13].

4. How addiction works on human

According to the definition of American Association of Addiction Medicine (ASAM), addiction is a major chronic disease affecting the circuits regulating memory, motivation, and reward in the brain.

4.1. Methamphetamine

Although many studies have been conducted on animal models, the main neurotransmitter that responds the pleasure effects are uncertain because of the lack of data from brain lesion and deep brain stimulation. But there is still enough evidence from the image of human brain shows that METH increases the dopamine release in the subdivision of the striatum, to be specific, the caudate, putamen and the ventral striatum. There is also research showed that many hallucinations are caused by the unusual function of the striatum dopamine system [3]. The authors explained that the antagonist of dopamine receptors can stabilize the psychosis symptoms, but the agonist of dopamine receptor can cause those symptoms. In short, the reward built by the ability of increasing extracellular dopamine level of METH encourage the patient to try it, and, therefore, cause addiction [14]. Long term use of METH can cause drug tolerance, which means that the patient will use it with an increasing dosage and frequency over time passing by, and finally cause some symptom like the failure of organs which has been mentioned on the former paragraph.

4.2. Methamphetamine psychosis

As the former paragraph introduced, the usage of METH at a relatively low dosage will cause some psychotomimetic symptoms, which enhance with the increasing doses, such as concentrated attention. But after a certain dosage, the psychotomimetic symptom will turn into some psychotic symptoms like paranoid delusions, tactile, and auditory hallucinations, which is also known as METH psychosis. According to the approximate data, up to almost 40% of METH user are affected by MET psychosis [15]. Research showed that chronic METH abuse can gradually cause the psychosis symptoms even after a long-time abstinence [16]. METH sensitization can also induce METH psychosis and develop during abuse [17]. There are three core characteristic of METH sensitization found in the clinical investigation: continuous progression of the psychotic, from mild symptom to severe symptom; more vulnerability for the relapse of psychosis, and long-time duration for relapse.to brain, to nerves, etc. (Pharmacologic analysis of them). In short, METH psychosis is a kind of chronic sequel that might induce relapse and psychotic symptom of METH abuse. Antipsychotics like risperidone and olanzapine are used in the

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medical therapy of METH, and some small trials of these medicine shows that they are efficacious in the treatment.

5. LSD

There are many views suggested that LSD is a non-addictive drug, but people can still be addicted to the hallucination that caused by LSD, and finally cause some negative side effects like psychosis, sometime suicide ideation [10]. Those symptoms of tolerance mentioned in the former paragraph can disappear after a few days of abstinence. Therefore, there are rare information about the medical therapies of addition of LSD, but some cases of using LSD as a medicine to treat the narcotic addictions [18].

5.1. Heroin

Heroin can get into the brain with blood for a short time (about 10 seconds), and then combine with the opioid receptors, which has been mentioned in the former paragraph [12]. It also stimulates VTA on the midbrain, which can induce the release of dopamine and subsequently produce the desire [13]. Long-term using with an increasing dosage can change the brain, and the reward of the brain will 'enforce' the patient to use heroin continuously.

6. Anti-drug therapies

The US Food and Drug Administration (FDA) has not approved any kind of medical therapies for METH addiction. However, as the former paragraph said, medical therapies for the opioid drugs like heroin are relatively mature. Methadone, naltrexone is using for the detoxification of opioid addiction. Methadone affects the same target in the brain which can also be affected by heroin, meanly reduces the desire for heroin [13]. Naltrexone blocks the effect of opiate to the receptor in the brain, but this can be only used on the detoxified users.

As a potential therapy of treating METH addiction, a study showed that the sigma-1 receptor, which is mentioned in the former paragraphs, can be a potential target of treatment of METH addiction, because in the animal experiment, they found that sigma-1 receptor ligands can modulate the transmission of dopamine and the behavioral effect of METH [19]. The new medicine mainly targets the neurotransmitter system, and also sigma-1 receptor. Sigma-1 receptors are related to a lot of psychotics and memorable disorders.

6.1. Behavioral therapies

Behavioral therapies mainly help patients to change their attitude to the drugs and persist with the medical treatment [20]. There are cognitive-behavioral therapies, multidimensional family therapy, motivational incentives and motivational interviewing. These therapies are intended to prevent patients from relapse, to improve their family functioning and to encourage abstinence from drugs. They are also necessary in the detoxification process.

6.2. To reduce the relapse rate

Medical therapies are important on detoxification, but they are not the only approach. The relapse can be influenced by social, psychological, and neuropsychological factors. Therefore, enhancing the intensity of restriction of drug transaction and improving the anti-drug education are also vital on reducing the relapse, because this is a way to solve the problem from its origin. However, the research of effective medicine is indispensable, which needs more subscribes of researchers. To prevent from relapse, medicine should have the abilities to help the recovery of brain function and reducing desire. The medicines for the treatment of opiate like heroin is relatively mature, but the medicine for the treatment of METH is in research and development.

7. Conclusion

In conclusion, this paper analyzed some information of the symptom, mechanism of addiction, and some specific psychotic symptom caused by different drugs including METH, LSD, and heroin. The existing

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and potential approaches of treatment were also included and compared in the article. However, the biological studies on drug abuse and the medical development on anti-drug treatment is not enough. Still, to avoid the bad effects of drugs on the stability of our society, medical researchers still need to study more on the restriction and development of the medicines to help detoxification and prevent relapse. This paper might help you find the direction of researching on the drug abuse.

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