



REVIEW ARTICLE

The effect of cocaine addiction on human and its treatment

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Abstract

This review article explains the action of cocaine addiction on human cells. In recent years, workers are trying to investigate that how cocaine addiction affects human cells and causes diseases and what is the proper and accurate treatment of cocaine addiction. Various medicines and therapies are available for the treatment of cocaine addiction but no one prove 100 % effective, so, this article provides the basic or essential information about cocaine addiction which would be proved very favorable to investigate its treatment and also its mode of action. The leading drug that stimulates the brain by blocking the dopamine, nor epinephrine and serotonin uptake transporters is cocaine. It produces motivation and consideration as well as increased excitement, focus and motor action due to which heart rate and blood pressure is increased. Due to all of these, it causes Pulmonary Hypertension, Anemia, Cardiovascular complications, Cerebral Vasoconstriction, Sudden Death, Renal infarction, Human Immunodeficiency Virus (HIV) infection, Neuropsychiatric disorders etc. The hydrochloride salt and free base are the two forms of the cocaine. The drugs which are used for the treatment of cocaine addiction are Buprenorphine, Bupropion and Bromocriptine and several others. The most important treatment of the cocaine addiction is the use of Acupuncture because it has no side effect but yet no evidence is proved of its efficiency.

Keywords

Cocaine addiction
Cocaine addiction side effects
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What is Cocaine?: Cocaine is an alkaloid obtained from the coca plant. The first evidence which prove that human used cocaine comes from Archeological specimen date since 3000 BC. The leading drug that stimulates the brain is cocaine. People who use cocaine become strong addict. They use more and more cocaine to fulfill their demand. In streets it is sold in a white powder form. The hydrochloride salt and free base are two types of the cocaine. This salt dissolve in water and people take cocaine through vein and nose while the free base can be smoked. The free base which can be smoked has common name crack (Warner, 1993).

Mechanism of action: Cocaine is the strong blocker of dopamine, norepinephrine and of serotonin. Cocaine produces motivation and consideration and also

increases excitement, focus and the action of motor. The blood pressure and the rate of pulse are increased by cocaine addiction. It also induces the discharge of CRF.

The Metabotropic receptor causes the slow synaptic communication. There are two main structures or functional units of G protein. The 1st is Alpha subunit which causes the conversion of the guanosine triphosphate into the guanosine diphosphate and the 2nd is Beta- Gamma dimmer that relates to the alpha subunit during attachment with GDP.

The G protein is activated by the attachment of the agonist. Alpha sub unit attach to the GTP afterward dissociate from its beta and alpha subunits. Alpha and beta sub units formulate dynamic or sluggish enzymes

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that make another messenger the same as cAMP, cGMP, ITP and diacylglycerol. In addition, beta and gamma subunits openly handle all ion channels (potassium, calcium and sodium ion channels). The activation of protein kinases (which phosphorylate ion channels) helps the second messenger to control ion channels. The protein kinase also affects the pharmacologic effect and formulates changes in the transcription factor. So this shows that cocaine indirectly increases the synaptic level of dopamine, nor epinephrine and also of serotonin. In result, all that neurotransmitters make active the various subtypes of the dopaminergic, the adrenergic and the serotonergic receptors (Cami and Farre, 2003; Goldstein et al., 2007; Frank et al., 2008; Dezfouli et al. 2009).

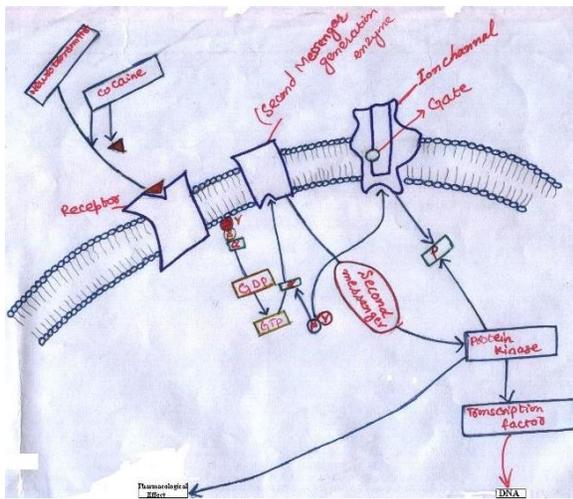


Figure 1: Mechanism of action of cocaine

The most important part which is affected by cocaine is corticotrophin releasing factor abbreviated as CRF. CRF perform a key role in the normal route of cocaine addiction. This is happened by accelerating the gaining of psychostimulant personality government and rising inspiration or motivation of the cocaine itself and also by some other factor. The stresses which induce CRF consider a predictor of weakening is responsible in favor of thoughts of grief and departure in cocaine leaving. It is because when cocaine enters in the human cells it increases the level of dopamine and when this level is lower then cause the feeling of worry, grief etc. which causes neuroplastic changes. So, the neuroplastic changes occur due to the addiction of cocaine which causes the disorders of the function of dopamine and glutamate (Pollandt et al., 2006, Guillem et al., 2010).

A single introduction of cocaine is enough to start continuous change on VTA glutamatergic synapses that look like activity-dependent long-term potentiation (LTP) in the different brain regions (Argilli et al., 2008).

What are the complications of cocaine addiction?:

The daily use of cocaine causes clear modification in the glutamate conduction in the limbic nuclei. This is shown by the preclinical study of the cocaine that cocaine addiction created the behavioral flexibility, in cooperation, the behavioral sensitization, personally administration, and the restoration of cocaine seeking for due to which cocaine cause a large variety of complications including direct toxicity and indirect effects. These complications are very dangerous and can cause death (DiRocco et al., 2009).

The cocaine causes two types of complication, systemic complications and indirect complications.

Systemic complications

Pulmonary Hypertension: The raise in the vascular pulmonary pressure that is caused by the increase in the pulmonary arterial pressure or the increase in both pulmonary arterial and the pulmonary venous pressure is called hypertension. Cocaine addiction increases the pulmonary vascular pressure due to which pulmonary hypertension happens (O'Leary and Chahine, 2002).

Anemia: These lines have been taken from a practice case report in which a patient has suffered from anemia. By testing, it was proved that the patient was used to alcohol in past but he had stopped drinking alcohol from one year and now he used crack cocaine frequently. Because of the regular usage of cocaine, he had become a strong addict and that's why he often skipped food (due to which he had deficiency of various nutrients) and suffered from iron deficiency anemia. This condition is also seen in some other patients of cocaine addiction (Weber et al., 2003).

Cardiovascular complications: Cocaine causes various cardiovascular complications due to its dangerous effects on various parts of hearts. It causes myocardial ischemia, infarction, myocardial dysfunction, dysrhythmias, endocarditis and aortic dissection.

Cocaine addiction increases the demand of myocardial oxygen. If there is a limited or low supply of oxygen then cocaine addiction may cause severe vasoconstriction in the coronary artery, accelerated atherosclerosis and also causes the thrombus formation. When thrombus formation takes place in coronary artery it improves the activation and aggregation of platelets and also increases the level of plasminogen activator inhibitor (which also encourage the formation of thrombus).

The patients which use cocaine undergo myocardial ischemia or infarction and have a deep chest pain when the amount of cocaine in blood is highest. Cocaine causes shrinkage in the diameter of arteries due to which myocardial ischemia or infarction occurs.

All these cardiovascular complications are due to the effect of production and transmission of spurious cardiac impulses by cocaine addiction due to following mechanisms:-

First, cocaine addiction increases the ventricular irritability and decreases the threshold for the fibrillation. Second, it resists or stops the transmission and production of the action potential due to its ability of blocking sodium ion channels. In this process cocaine acts like class I anti arrhythmic agent. Third, cocaine addiction increases the level of intracellular calcium. This causes the disturbance in the depolarization and may also cause ventricular arrhythmias. Fourth, cocaine addiction also decreases the vagal activity which results in cocaine's sympathetic effects (Kaufman et al., 1998; Lange and Hillis, 2001; Du et al., 2006; Ford et al., 2009).

Cerebral vasoconstriction: Cocaine causes abnormal changes in the heart rate and also in systolic and diastolic pressure which results cerebral vasoconstriction (Martin-Schild et al., 2010).

Sudden death: Cocaine addiction can also cause sudden death by affecting several cells mechanisms which may be responsible for sudden death including arrhythmias, status epileptics, centrally mediated respiratory arrest, congenital, coronary artery anomalies and intracerebral hemorrhage (Lucena et al., 2010).

Renal infarction: Cocaine metabolites collect in urine and cause renal infarction which cause rapid pain in abdomen. In cocaine addiction, various physiologic mechanisms cause platelet activation along with vasoconstriction and endothelial damage which results renal infarction. There is no proved treatment for this complication (Maron, 2003; Hoefsloot et al., 2009).

Indirect complications: Neuropsychiatric disorders (mental disorders of nervous system caused by medicines or drugs) are often characterized by impaired insight into behavior. It also causes HIV infection, criminal activity and negative social interactions (Moeller et al., 2010; Sullivan et al., 2010).

Human Immunodeficiency Virus (HIV) infection: Cocaine causes HIV infection because it is a great stimulant and aphrodisiac and often causes disinhibition. The urban cocaine culture is characterized by crack houses where drugs are often exchanged for sexual favors due to which unhealthy sexual contact happens and HIV infection occur. In addition to these infections, there is a risk of the diversity of other bacterial infection (Gordon and Lowy, 2005; DeBeck et al., 2009).

Therapy for cocaine addiction: Different researches and experiments proved that many drugs or medicines and treatments are affective for the treatment of cocaine addiction. From these medications, some medicines are given below.

Buprenorphine, bupropion and bromocriptine are the valuable medicines for the treatment of cocaine addiction. The daily dosage of buprenorphine (12 mg per day), bupropion (150 mg per day) and bromocriptine

causes the major decrease in the intravenous cocaine use. It also decreases the symptoms of depression which are caused by cocaine addiction (Weiss, 1989; Avants et al., 1998).

The DNA methylation rate of OPRM1 gene (present in the lymphocytes of the cocaine addicts) is significantly increased by the use of cis acting polymorphism and also by the functional haplotype in the PDYN gene. So this technique is proving very successful for cocaine addict patients (Yuferov et al., 2010). And also the apply of beta-receptor antagonist and class Ia and III anti-arrhythmic is strongly depressed if the patient is likely to continue cocaine use, because of documented adverse effects (Phillips et al., 2009).

Auricular acupuncture is broadly used for the treatment of cocaine addiction because it is a very safe treatment of cocaine addiction and it does not affect the other body parts or other cells. But this treatment is not using now a days because no evidence is proved of its competence. So, research is required to make this treatment effective for cocaine addiction (Margolin et al., 2002; Mills et al., 2005).

The cocaine pharmacotherapy in concert with dopaminergic and GABA drugs are used to treat cocaine addiction. Various dopaminergic medicines are tested for the pharmacotherapy of cocaine. Among these, amantadine and disulfiram are proved very effective to decrease cocaine addiction (these medications are also effective for removing strictness). GABA is very important inhibitory neurotransmitter which amends the dopaminergic systems and also adjust the cocaine effects. Tiagabine and topiramate are also anticonvulsant drugs which have the same affect as GABA and so these are also proved affective for cocaine addiction. Baclofen is a GABA receptor agonist that is very competent for cocaine addiction treatment but it is used for severe cocaine addiction. The physiological and behavioral effects which are produced by cocaine addiction are also controlled by propranolol and beta adrenoceptor antagonist. Many other treatments like cerebral vasodilators (e.g. amiloride or isradipine), immunotherapies and cocaine vaccination are also used for the treatment of cocaine addiction but further research is required to improve these treatments (Nunes and Levin, 2004; Sofuoglu and Kosten 2005; Brodie et al., 2009).

The reversible inhibitor of GABA transaminase (the primary enzyme concerned with GABA metabolism) like vigabatrin is also used to treat cocaine addiction. Acute administration of vigabatrin increases brain GABA levels and these increases in GABA-ergic transmission has an inhibitory effect on dopaminergic transmission and centrally mediate reward systems (Fechtner et al., 2006, Brady, 2009).

The most attractive treatment of the cocaine addiction is rhodococcal cocaine esterase which directly breaks the cocaine into inactive forms. This treatment is not used mostly because the serum half life of rhodococcal cocaine esterase is very short and research is needed to increase its serum half life (Brim et al., 2010).

N-acetylcysteine decreased the aspiration of cocaine and also the cysteine glutamate transport act as a potential pharmacotherapeutic target for the treatment of cocaine addiction (LaRowe et al., 2007).

Environmental contingency inherent in neighborhoods and communities have been shown to affect individual behavior. In short, the most important and effective treatment of cocaine addiction is to avoid the company and environment of cocaine users or addicts which will be proved more effective to cure the cocaine addiction (Stahler et al., 2009).

Conclusions: By studying the adverse reactions of the cocaine we can diagnose various disorders like dilated cardiomyopathy or myocarditis, arrhythmias, infarction or myocardial ischemia and other mental disorders. In short, the perceptive and premature detection of cocaine related disorders are necessary to their correct managing and some important and necessary laws should be applied to stop the use and availability of cocaine. Researchers and scientists should also pay attention for finding the proper and exact treatment of cocaine addiction by modifying the above treatments and medications.

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