Orally ingestion of krokodil in Spain: report of a case

Consumo de krokodil por vía oral en España: a propósito de un caso

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Abstract

The krokodil use disorder is an addictive pathology with quite severe organic effects, especially at the skin level, that causes severe and degenerative necrosis of blood and muscle tissue. Though this disorder has a low prevalence in Spain, compared to the large number of consumers in other countries such as Ukraine or Russia, its consumption is slowly but gradually expanding in countries of the European Union and America. The simplicity of the process of obtaining the substance from desomorphine, together with its high availability and low cost, contribute toward consumers' self-sufficiency. This article presents the case of a user of krokodil and reviews the clinical symptoms of oral ingestion.

Keywords: Krokodil; Substance use; Oral ingestion; Desomorphine.

Resumen

El trastorno por uso de krokodil es una de las patologías adictivas con mayores repercusiones orgánicas, principalmente a nivel cutáneo, produciendo una grave y degenerativa necrosis del tejido sanguíneo y muscular. Se trata de un trastorno con escasa prevalencia en España, frente al elevado número de consumidores en otros países como Ucrania o Rusia, si bien se está produciendo una lenta aunque gradual expansión del consumo en países de la Unión Europea y del continente americano. El sencillo proceso de obtención de la sustancia desde la desomorfina, unido a la elevada disponibilidad y bajo coste, configura el proceso de autoabastecimiento de los consumidores. En este artículo revisamos un cuadro clínico, presentando el caso de un paciente que consume krokodil por vía oral.

Palabras clave: Krokodil; Uso de sustancias; Vía oral; Desomorfina.

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Desomorphine or krokodil is one of the most-frequently consumed substances in some countries of northern Europe and the former Soviet Union, and is quickly expanding through the United States and South America. At the same time, given its high addictiveness, low cost and ready availability, as well as the incidence of serious organic pathologies associated with its use, its social and health-related repercussions for the user demand attention (Heimer, 2013). Despite the start of its consumption in Russia, Ukraine and Georgia at the end of the last century, clinical interest in the use of krokodil is currently under focus due to its potential organic deterioration and addictiveness for the user. Determinant factors also exist behind the great social alarm and media coverage given to the process of krokodil use as a whole. One of these aspects is the easy access to the substance, starting with the rudimentary, home-based synthesis of krokodil; another determinant is the dissemination of the users' serious clinical symptoms exhibited by media sources and the Internet (Gahr et al., 2012). Over the last five years, a growing number of reports on the prevalence of substance use claim a notable reduction of inhaled opium and parenteral consumption of heroin in Russia, Ukraine, Kazakhstan and Georgia, while at the same time reporting a notable increase of the use of drugs containing codeine (*Solpadeine, Codterpin* or *Codelac*) used for producing desomorphine (Savchuk, Barsegyan, Barsegyan & Kolesov, 2008). The ongoing economic crisis of these countries, together with the relative availability of legal precursors at pharmacies, promotes, to date, a culture of homemade substances, like alcohol, krokodil or -as an example of the abovementioned- the use of *Pervitin* (methamphetamine) in Prague since the early 1980s (Zabransky et al., 2012).

This self-supply model differs from that of other countries, where drug trafficking dominates drug production and distribution. Apparently economic factors are the determinants of krokodil use (Grund, 2002), as there is already proof of the home-based manufacturing of desomorphine in areas with high unemployment rates and economic problems, as is the case in some states of the United States, Mexico and Holland (Kwint, Kruizinga, Kaal & Bootsma, 2013).

The molecule dihydrodesoxymorphine: C17H21NO2, desomorphine, or the brand name *Permonid*, is similar to the opioid synthesized in 1932 in the United States by the chemist Lyndon Frederic Pequeño. Desomorphine is a derivative of morphine with the elimination of the 6-hydroxyl group and the reduction of the 7,8 double bond. Traditional synthesis of desomorphine is based on α-chlorocodide, in turn obtained by provoking a reaction of thionyl chloride with codeine. Through catalytic reduction, the α-chlorocodide produces dihydrodesoxycodeine, which through demethylation leads to the formation of desomorphine (Eddy, Halbach & Braenden, 1957) (Figure 1). Given its structural similarity to morphine, it is suggested that desomorphine is a potent *mu* opioid agonist with higher toxicity and analgesic power of between 5-10 greater than morphine. The effect of desomorphine is produced approximately two minutes after consumption, and lasts, on the average, between 60 and 90 minutes (Eddy & Howes, 1935).

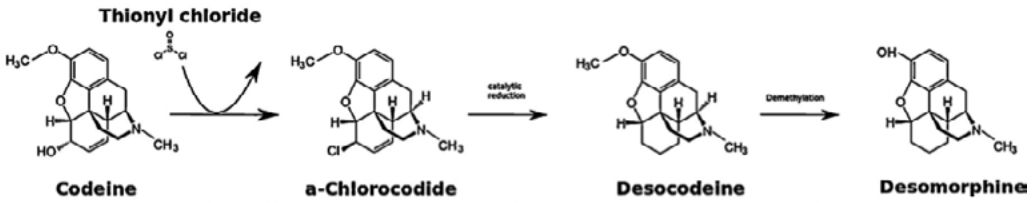
Figure 1.

The leading and diverse medical purposes for which desomorphine or *Permonid*® was sold as hydrobromic acid salt included analgesic, antitussive and even sedative uses. However, its side effects (hypotension, urinary retention, vomiting and drowsiness) together with a fast development of addiction in humans, resulted in its withdrawal from the market (Matiuk, 2014).

The neologism krokodil arises from its pronunciation similar to chlorocodide, as well as for the lesions users suffer at the epithelial level, which with a greenish hue and scaly appearance remind us of the skin of a crocodile. Elaborating the substance is simple and inexpensive. In most cases, patients manufacture krokodil in their own home by combining hydrochloric acid, iodine and red phosphorus with codeine, though different preparations, like organic solvents or tropicamide, cheapen the process. This procedure is similar to the synthesis of methamphetamine from pseudoephedrine (Abdala, Grund, Tolstov, Kozlov & Heimer, 2006).

The main ingestion routes of krokodil are oral and parenteral, the latter entailing serious consequences for the organism, including HCV and HIV infections and even provoking endocarditis. Injuries associated with the injection of krokodil are considered serious and are unprecedented within physical consequences of drug use. The main focus of clinical concern, and the greatest complication resulting

Figure 1. Synthesis of desomorphine using codeine



of the use of krokodil, are its effects on blood tissue: abscesses, phlebitis, thrombophlebitis, hemorrhages and ulcers that appear close to the injection site, as well as damage to muscles, soft tissues and bones, with fast necrosis and gangrene. In most cases, interventions for these conditions require extremely complicated surgeries with serious aftermaths, such as surgically removing the main veins from arms or legs, sometimes requiring amputation or skin grafts (Demidova & Mokhachev, 2011). The toxic effects of krokodil are not only limited to muscular vascular lesions; the substance's toxic components, like iodine, damage the thyroid and muscles, and phosphorus seriously deteriorates cartilage (Harris, 2013). In turn, these toxic compounds damage the neurological and endocrine systems, as well as the organs that intervene in the metabolism of chemical products and heavy metals used in the substance's synthesis. The initial symptoms appear just a few days after the first intravenous krokodil injection and include organic symptoms, the most common of which are: pneumonia, meningitis, periodontitis and osteomyelitis. This process and the organic symptoms together result in users' gradual physical deterioration with very high mortality rates, though not all users experiment the extreme harm associated with krokodil (Grund, Latypov & Harris, 2013).

The psychological consequences of use are usually not as defined. Together with the evident and progressive process of substance dependency there also coexists notable neurological damage, speech impediments, loss of motor skills, altered memory, mood disorders and even psychotic episodes (Matiuk, 2014).

Clinical case presentation

Our case is a 34-year-old male user of the services provided by CIBE in Castellón de la Plana, with prenatal and perinatal developmental stages unmarked by any events worth highlighting. As to medical evaluations, no data of interest are detected, with a medical examination and blood test completed in September 2014, with no relevant alterations in blood range parameters. He has a secondary level education level, is currently unemployed, and his stable partner inhales cocaine regularly. As an adult, he was imprisoned for 5 months. The most noteworthy fact of his family background is his father's alcohol use disorder.

His first experimental use of cannabis and alcohol began during adolescence, snorting cocaine at age 19, followed by habitually smoking cocaine and heroin as of the age of 20, while occasionally abusing of benzodiazepines ingested orally. The patient underwent different detoxification treatments at the Hospital Detoxification Unit and addiction treatment programs at the In-patient Drug Addiction Unit, was discharged and now alternates periods of abstinence and active use. Currently, the patient undergoes no type of treatment and has a disorder from using benzodiazepines, cocaine and smoking heroin.

As to the reason for his visit, the patient mentions having acquired and consumed krokodil orally, combined with a caffeinated beverage as a recreational experiment. He mentions the substance's distinct bitter taste, even when dissolved in the mix, and mentions detecting its effects 20 minutes after ingesting it. The patient describes the effects as itchiness across the entire body, increased temperature of the stomach that rises up toward the head, sweating, altered breathing and an evident slowing down, headache and a noticeable sensation of relaxation and sedation of the rest of the body. The patient describes this like "the effect of heroin but much more physical, stronger" and despite his previous experience with opioid use, describes these symptoms as more greatly affecting the organs while disassociated from the intoxication or abstinence syndrome inherent to heroin. Interference on behavior of these is minimal, as the patient can continue with his normal functions. At the same time, he does not report any serious alterations to his judgment, will or consciousness, though he does mention symptoms of moderate anxiety and slight depersonalization.

Two hours after the ingestion, the patient experiences vomiting and stomach ache and progresses from feeling slightly feverish to having fever, congruent with a possible indigestion or gastroenteritis. The patient does not associate this with the use of krokodil and evolves favorably, under the care of the primary care system during three days.

Discussion

This case entails the oral ingestion of krokodil, wherefore we detect the first case of krokodil use in Spain. Seemingly, the expansion to Europe of krokodil use is associated with the economic crisis, as this is possibly the cause behind the appearance of the first use in Spain, where an increased use of amphetamine derivatives, such as α-Hydroxybutyric acid (GHB) or ketamine (Nogué, Amigó & Galicia, 2014), has also been detected.

In this case, the oral ingestion of the substance is worth highlighting, as opposed to the higher prevalence of the parenteral route, given the scarce evidence of alternate forms of use (Merkinaite, Grund & Flimpond, 2010). In an initial phase, the physical symptoms and mental effects as perceived by the patient are verified, while confirming the use of opioids with a urine drug test. It would be convenient to perform more specific toxicological analyses for purpose of detecting new, emerging drugs or substances that fall beyond the scope of classical analysis types. The detected symptoms are inherent to the effects of opioid use, yet simultaneously display other, less-specific symptoms. These clinical symptoms detected in the patient after consumption could comprise a lighter version of the symptoms of intoxi-

cation by opioids with effects on the central nervous system and digestive system.

Krokodil consumption presents serious physical symptoms associated with the ingestion route, mainly as regards parenteral ingestion, such abscesses, phlebitis, thrombophlebitis, hemorrhages and ulcers (Rhodes, 2009). However, the patient does not show signs of intravenous krokodil injection but rather, the possible consequences of consumption associated with oral ingestion. The patient was monitored since 2008 by the CIBE assistance unit, without having been detected any type of psychopathological alteration in previous periods of intervention, assessment and follow-up. Nevertheless, psychopathological repercussions of occasional krokodil use are not significant.

The expansion and use of krokodil is a reality in Europe, and given this case, we can confirm the start of its use in Spain. For this reason, healthcare professionals, at both levels of primary care and emergency rooms, as well as mental health and addiction-related services, must be watchful to detect intoxications, abstinence syndromes or physical and/or psychopathological effects of its use.

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Conflict of interests

The authors declare the inexistence of conflicts of interest.

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