

## Physical and psychological effects of the new legal high 'Ivory Wave': a case report

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### ABSTRACT

**Introduction** 'Ivory Wave' is a designer drug that has been popular amongst young people since the ban of mephedrone in the United Kingdom (UK) last April. It is easily available from the Internet where it is advertised as a bath salt. Recently, a spate of Ivory Wave-related hospital admissions were reported around the UK, and this has raised concerns about the effects of the substance. However, limited information is available regarding the physiological and psychological effects of the drug.

**Case presentation** We report the case of a 26-year-old Caucasian male who presented to Accident and Emergency (A&E) after snorting a large amount of Ivory Wave. He presented with severe agitation, paranoid delusions, and auditory and visual hallucinations. He also complained of breathing difficulty and involuntary movements of his limbs. He was pyrexial and tachycardic but the rest of physical examination was unremarkable. The main laboratory findings included an elevated white cell count, C-Reactive protein (CRP) and creatinine kinase (CK). These markers gradually fell to their normal ranges within a week. The involuntary movements disappeared too. The patient required occasional lorazepam and regular diazepam for his agitation. This improved after approximately a week as the paranoid delusions and hallucinations wore off.

**Conclusion** The side effects of Ivory Wave include over-stimulation of the cardiovascular system and the nervous system with potential risk to heart and kidneys. Mental state can also be severely disturbed with agitation, paranoid delusions and/or hallucinations.

### Introduction

The legal high 'Ivory Wave', also known as 'Ivory Coast', 'Purple Wave' or 'Vanilla Sky', is a designer drug that has become popular among clubbers in the United Kingdom (UK) after mephedrone was banned in April 2010.<sup>1</sup> Ivory Wave is advertised as a relaxing bath salt and has been freely available on the Internet for about £15 a packet (200mg).<sup>2</sup> Three different versions have been on the market, namely, Ivory Wave, Ivory Wave Ultra (also known as Ivory Wave 2), and Ivory Wave 3, although their differences are unknown.<sup>3</sup> Studies have shown that Ivory Wave contains cathinone-derived stimulants and, when snorted in high doses, bring similar effects to those of amphetamine and ecstasy.<sup>4</sup>

Recently, clusters of hospital admissions have been reported around the UK following the use of Ivory Wave. The majority of patients were described to have 'acute paranoid psychosis' with severe agitation, which wore off after a couple of days.<sup>5</sup> However, some patients had more serious physical complications and had to be monitored in the coronary care units for up to 12 hours.<sup>2, 5</sup>

Following the increase in the number of Accident and Emergency (A&E) admissions relating to Ivory Wave, healthcare professionals have expressed their concerns about the harmful effects of the substance. The Department of Health has issued advice on handling the users who may present to health services for help.<sup>6</sup> However, the literature is limited on the physical and psychological effects of the substance at present.

Therefore, we report our case here to describe some of the clinical features of Ivory Wave misuse.

### Case presentation

A 26-year-old Caucasian male, with a background history of obsessive-compulsive disorder (OCD) and depression, attended an Accident A&E after snorting approximately 700mg of 'Ivory Wave Version 3' in a day. He presented with severe agitation, persecutory delusions, and auditory and visual hallucinations. He stated that 'people' were trying to kill him and his mother with a knife, and he could hear their voices threatening to kill him. He also complained of mild/moderate breathing difficulty and involuntary movements of his arms and feet.

In recent years he had been 'experimenting' with several legal highs, including Ivory Wave, 'Charge' and 'Mojo'. Five weeks prior to this admission he had visited A&E with a similar presentation, but without persecutory delusions, after sniffing an unknown amount of 'Ivory Wave 2'. The hallucinations shortly disappeared and he was discharged home.

Otherwise, he was physically fit and well. He had a long history of severe OCD with borderline psychotic features/social anxiety where he was consistently worried about what other people may do to him. There was no personal or family history of psychosis. He was taking clomipramine (125mg) and olanzapine (12.5mg) for OCD and depression but his compliance had been erratic before the admission.

In the present admission he was very agitated and restless. He had non-goal-directed involuntary movements on both arms and feet: repetitive flexion of his elbows and dorsiflexion of his ankles. The physical examination showed that he was pyrexial with a temperature of 37.9°C and had bilaterally dilated pupils. The respiratory examination was normal with an oxygen saturation of 98% on air. The heart rate was slightly fast at 109 beats per minute (bpm) and blood pressure was 122/82 mmHg. The rest of examination was unremarkable with a normal electrocardiogram (ECG). Laboratory investigations revealed a raised white blood cell (WBC) count of  $23.5 \times 10^9/L$  and C-reactive protein (CRP) of 332 mg/L. He also had hyponatraemia ( $Na^+$  126 mmol/L) and elevated creatinine kinase (CK = 662 iu/L). Urine drug screen was negative to amphetamine, opiates, cannabinoids and cocaine.

Initially the patient was admitted to a medical ward and commenced on normal saline with intravenous antibiotics (co-amoxiclav) because of the raised inflammatory markers. The body temperature, CRP, and WBC count fell gradually; the CK level dropped as well. The blood culture came back negative. However, the patient remained agitated, was running around the ward, and experiencing visual and auditory hallucinations. He required PRN lorazepam and regular diazepam.

On day five of admission the patient was deemed medically fit and discharged from the medical ward. However, he was still agitated and confused about what had happened. Concerns were raised regarding his mental state, given his past psychiatric history and current problems. A Mental Health Act assessment was performed and the patient was admitted to a psychiatric unit under Section 2 of Mental Health Act 1983 on the same day.

On admission to the unit the persecutory delusions and hallucinations were still present but to a mild degree. The involuntary movements appeared more like muscle twitches, which occurred less frequently. He was observed on the ward and only PRN lorazepam was prescribed together with his regular medication. He then settled on the ward and did not require any further PRN medication.

After a few days the persecutory delusions and hallucinations wore off. The involuntary movements had stopped but left patches of numbness on his right arm, mainly on his fingers. The area was poorly defined and was not localized to a specific dermatome. The numbness disappeared after a few days without any complications.

The patient remained in the psychiatric unit for two weeks before discharge to the care of the Community Mental Health Team (CMHT).

## Discussion

The exact components of Ivory Wave are unclear and thought to be variable.<sup>4,7</sup> Studies have shown that the main ingredients include MDPV (3,4-methylenedioxypropylvalerone); desoxypipradrol, also known as 2-diphenylmethylpiperidine (2-DPMP); and lidocaine.<sup>7, 8, 9</sup> MDPV and desoxypipradrol are both synthetic stimulants. MDPV was first synthesized in 1969<sup>10</sup> and is found as a white or light tan powder.<sup>4</sup> Desoxypipradrol was initially developed by a pharmaceutical company in the 1950s as a treatment for Attention Deficit Hyperactivity Disorder (ADHD) and narcolepsy, but it was replaced by other related substances.<sup>8</sup> They both act as noradrenaline and dopamine reuptake inhibitors and their effects are thought to be similar to those of amphetamine and cocaine in high doses.<sup>9, 11, 12</sup>

Ivory Wave is known to bring on several desired effects, including increased energy and sociability, increased concentration, and sexual stimulation. There are also many physical and psychological unwanted effects reported including insomnia, severe agitation/anxiety, panic attacks, kidney pain, stomach cramps, tachycardia, hypertension, dilated pupils, headache, tinnitus, skin prickles and numbness, dizziness, and dyspnoea.<sup>4, 13</sup> These effects appear highly dose-dependent<sup>4</sup> and have been based on self-reports made by users on online forums.

In the UK there have been several media reports of hospital admissions related to Ivory Wave. The majority of patients were described to have acute psychotic symptoms, namely paranoid delusions, and auditory and/or visual hallucinations. A few of them had physical complications, requiring cardiac monitoring in ICU.<sup>1, 2, 5</sup> However, no detailed description of their clinical features were available.

In this case report, we have described chronologically the clinical features of a patient, who presented to A&E after taking Ivory Wave. The patient had a similar presentation to what it was described by Paolo Deluca and his colleagues.<sup>4</sup> The patient also experienced involuntary movements in his limbs which has not been reported before in the literature. We have also reported the blood test results: raised inflammatory markers (WCC and CRP) and CK.

The findings from this case, in combination with the limited literature, suggest that the use of 'Ivory Wave' can lead to serious complications including over-stimulation of the cardiovascular and nervous system, hyperthermia, and acute psychosis which can potentially result in severe illnesses or even death. The risk of these effects would be greater if the drug was combined with other recreational drugs or alcohol. In addition, the exact composition and strength of the substance may vary and users may not be completely aware of what chemicals they are consuming. This implies that users of Ivory Wave may be taking potentially dangerous substances with unknown effects.

In April 2010, MDPV was made a Class B drug in the UK together with other cathinone derivatives. In addition the UK Home Office has recently announced a ban on the *import* of desoxypradol and any products containing the chemical.<sup>15</sup> The use and availability of Ivory Wave in the UK is being closely monitored and may result in further legislative review. Changes in legislation, more research studies, and health education on Ivory Wave could help the public to realize that, irrespective of the legal status of a drug, recreational use of substances may pose a significant risk to their health.

#### Competing Interests

None declared

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