

# Case Report

## Drug Toxicity Following Trip to the Local Head Shop

**Urgent message:** Thorough work-up is mandatory for patients with mild symptoms from recent use of “bath salts” because of the potential for multi-systems failure.

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### Case Presentation

A 19-year-old male is brought to an urgent care clinic by his mother, who states that her son and his friends took “Molly Mosquito Caps” 2 days ago that were purchased from a local head shop. The patient and his friends all experienced nausea and vomiting after taking the product. The patient’s friends improved a day later and no longer have symptoms but the patient has not. His mother is very concerned because her son is still “sick” and there was blood in his emesis this morning.

### Pertinent Physical Exam

On presentation the patient is very pale, cold to the touch on his hands, and appears obtunded. He is conscious but his verbal responses and eye contact are both poor. Bilateral mottling on his hands was noted during nursing triage. His blood pressure (after a second attempt) was 80/50, pulse was undetectable, respirations 12/min and shallow, O<sub>2</sub>SAT 80% to 83% on room air. The patient was immediately placed on oxygen and 911 was called.

Upon admission to the emergency room, the patient was severely dehydrated and desaturating. His O<sub>2</sub>SAT was fluctuating in the low 80s with oximetry maintained via nasal cannula. He was also found to have leukocytosis (likely reactive), polycythemia, an electrolyte imbalance, an elevated creatine kinase level,



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and acute renal failure.

### Observations and Findings

Evaluation of the patient revealed the following:

- Sodium: 128
- Potassium: 4.8
- Chloride: 95
- Bicarbonate: 22.4
- BUN: 4
- Creatinine: 2.8
- Glucose: 292
- Magnesium: 1.3

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- AST: 82
- Total CK: 544
- CK-MB: 59
- Lipase: 39
- WBC: 39.9
- Hgb: 21.5
- Hematocrit: 54.3
- Platelets: 342
- Urinalysis: Unremarkable
- Drug toxicology: Positive for cannabis and amphetamines

Chest X-ray showed evidence of pulmonary edema, with a slightly globular left heart border. Head CT was unremarkable.

Sinus tachycardia was noted on electrocardiogram (EKG), with a rate of 135 beats per minute. Additional findings included early repolarization, minor lateral ST changes, and a left axis deviation. Subsequent EKGs began to show pre-ventricular contractions (PVCs).

Echocardiogram showed an estimated ejection fraction (EF) of 10% and decreased global hypokinesis (decreased or abnormally slow movement).

According to mother, this patient has no known drug allergies, no significant past medical or surgical history, and takes no medications.

### Course and Perspective on Mephedrone

Eventually this patient needed to be intubated, placed on mechanical respiration, and admitted to the intensive care unit (ICU). His O<sub>2</sub>SAT was 93% on ventilator settings.

After the patient was intubated and admitted to the ICU at the local hospital, the Center for Poison Control (CPC) was contacted in an attempt to find out what active ingredients were in the Molly Mosquito Caps. Our office was later contacted and informed that this product contains mephedrone. This drug is also found in other products, such as “Bath Salts,” which are available over the counter at many head shops and gas stations. These products typically have statements such as NOT INTENDED FOR HUMAN CONSUMPTION on them. However, this is sometimes taken as a “wink, wink, nod, nod” type of warning.

Currently there is only a limited amount of information about mephedrone effects on humans and its mechanism of action, toxicokinetics, metabolism, and toxicodynamics. In fact, many of the references used in this case report are very recent. However, what is known about mephedrone is that it is a synthetic cathinone that is a



designer drug of the phenethylamine class, which is structurally and pharmacologically similar to 3,4-methylenedioxymethamphetamine (MDMA or Ecstasy). The Drug Enforcement Administration (DEA) has issued an order to list mephedrone as a Schedule I controlled substance under the Controlled Substances Act (CSA).<sup>1</sup>

A recent study employed *in vitro* and *in vivo* methods and compared the neurobiological effects of mephedrone and methylone with structurally related compounds MDMA and methamphetamine.<sup>2</sup> The results stated that mephedrone is a nonselective substrate for plasma membrane monoamine transporters with potency and selectivity similar to MDMA. In this study, mephedrone was also found to produce dose-related increases in extracellular dopamine and serotonin. That is most likely what produces the desired “high” that users are seeking.

Subjective effects of mephedrone that were reported by users are impaired working memory, stimulant-like effects, and binge use.<sup>3</sup> Stimulant-like effects include palpitations, seizure, vomiting, sweating, headache, discoloration of the skin, hypertension, and hyper-reflexia. A different group of users reported increased energy, empathy, “openness,” and increased libido.<sup>4</sup>

Another recent study, which was conducted in Ireland, demonstrated that mephedrone can also be used intravenously (IV) and intranasally (IN).<sup>5</sup> This study reported that IV and IN users demonstrated compulsive re-injection with excessive binge use over long periods of time, intense paranoia, violent behavior, aggression,

emergence of Parkinson-type symptoms (which were described as spasms and loss of coordination), and permanent numbness in the lower extremities. Interestingly, Parkinson-type symptoms are also commonly reported in chronic cocaine abusers.

The Federal Register reported that the use of mephedrone and other cathinones have resulted in emergency room admissions and deaths. Some of these deaths were due to the effects of the toxicity of these drugs, which caused multisystem failure, and also from

individuals acting violently and unpredictably while under the influence of the drugs. Other adverse effects associated with consumption of mephedrone are epistaxis, bruxism, paranoia, hot flashes, dilated pupils, blurred vision, dry mouth, palpitations, muscular tension in the jaw and limbs, headache, nausea, vomiting, agitation, anxiety, tremor, fever, and sweating.

Mephedrone intoxication, also termed “stimulant toxidrome” or “bath salt intoxication delirium” can lead to severe cardiovascular and neurologic complications, and recurrent acute kidney injury, which has been reported with repeated use. This was seen in this patient after his admission to the ER and his subsequent admission to the ICU. More importantly, this is not an uncommon result of mephedrone use. In fact, this was seen in another case similar to this one. In the other case, a patient presented with severe cardiovascular and neurologic signs. That patient also developed rhabdomyolysis, hyperuricemia, and metabolic acidosis, and subsequently recurrent acute renal failure.<sup>6</sup>

Psychiatric complications (that is, intoxication delirium) have been reported with recurrent use of bath salts. According to one study, this intense psychosis is manageable acutely with antipsychotics.<sup>7</sup> The symptoms are most likely caused by the increases in extracellular dopamine and serotonin discussed previously. Of course these mechanisms of action were extrapolated from rodent studies. In addition, the dopaminergic effects of mephedrone may contribute to the addictive nature of the drug that was seen in the Ireland study, where compulsive binge use of the drug was documented with IN and IM use. These direct routes circumvent the first-pass

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effect of the liver and may also account for the more addictive behaviors in this group of patients. However, no current studies on human neuropharmacology have yet been completed. Consequently, the symptoms are real but the underlying pharmacology is intuitive speculation.

#### **Patient Outcome**

After 6 days in the ICU, this patient’s renal status improved, eventually returning to normal. His leukocytosis improved, as did the metabolic abnormalities. His cardiac

status, however, never improved and his EF remained at 15%. At that point, he was transferred to a cardiac transplant center as a potential candidate for a heart transplant. Unfortunately, the patient died 1 week later while awaiting a heart transplant.

#### **Discussion**

This patient experienced multiple systems failure days after ingesting Molly Mosquito Caps, which contain mephedrone. This drug is a schedule I controlled substance. Overseas manufacturers are able to circumvent this by exploiting loopholes in federal laws and placing “tongue in cheek” warnings on the product. These opinions were verified by a conversation that I had with a representative of the DEA Office of Diversion Control.

Online chat rooms contain statements from individuals who claim that they have taken bath salts, it was great, and they had no serious medical complications. The fact of the matter is that products containing mephedrone should be considered dangerous and life-threatening. In general, no product with the words “NOT INTENDED FOR HUMAN CONSUMPTION” or anything similar to that written anywhere on the label should not be consumed under any circumstances.

Amphetamines typically do not cause myocardial necrosis. In some cases, patients can become so dehydrated that they suffer a cardiac event. Our patient’s EKGs never showed any evidence of acute myocardial infarction. Furthermore, amphetamine cardiotoxicity typically presents with arrhythmias. In severe cases, ventricular fibrillation can be followed by cardiovascular collapse, but that is secondary to arrhythmia and not

specifically to myocarditis or myositis. However, as in this and other reports, patients have clearly suffered cardiac failure days after mephedrone use.

The patient's mother asked why her son's friends were fine a day later but he developed severe medical complications. That question cannot be answered beyond speculation. The product is not regulated by the FDA. Therefore, the actual dose of mephedrone can vary unpredictably from capsule to capsule, as can any of the other ingredients in these types of products. The patient's friends may have received 2 mg or 5 mg of the active ingredients, while our patient may have received 10 mg or 20 mg! In addition, everybody's body is different with a unique genetic makeup.

### Conclusion

As urgent care providers, it is important to keep in mind that patients may present to your clinic with milder symptoms after using mephedrone-containing products. However, multisystem failure could be at work and may not manifest for days after consumption. Therefore, a more stringent workup is mandatory, including ordering labs to evaluate renal and cardiac status, and performing a chest x-ray and EKG in an urgent care or primary care clinic. Our patient, for example, presented with more severe symptoms and was appropriately sent to the ER by ambulance and admitted into the ICU. Conversely, if he had presented a day earlier, his multiple system failure might not have been evident. Because clinical information and public awareness about the toxicity of mephedrone-containing products is limited, clinicians may be susceptible to missing the potentially life-threatening progression to multiple systems failure. Any patient presenting with milder symptoms with a history of recent use of any of these types of head shop products—especially mephedrone-containing products—demands a more thorough work up. ■

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