Purple Fentanyl: A New Face on an Old Enemy

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ABSTRACT

Introduction: Overdoses due to novel potent opioids continue to increase across the United States. The availability of colored fentanyl products that may appeal to younger patients is concerning.

Case Presentation: We present the case of an adult male with an unknown ingestion subsequently identified as purple fentanyl. Brorphine is a common component of purple fentanyl and is considered an emerging novel potent opioid.

Discussion: Only limited number of case reports describing brorphine exposure are available, and many clinicians remain unfamiliar with this substance. It is a potent opioid with a presumed long half-life. Clinical presentation is similar to that of other opioid toxidromes, including respiratory depression, miosis, and sedation, and is managed similarly. Patients may require extended monitoring after exposure to brorphine.

Conclusions: Awareness of emerging substances of abuse will enable clinicians to diagnose and treat affected patients more readily.

INTRODUCTION

Overdoses due to novel potent opioids continue to increase. In addition, the increased availability of colored fentanyl products that may appeal to younger patients is concerning. Purple fentanyl, also referred to as rainbow fentanyl, can be a combination of several substances – including fentanyl, carfentanyl, and brorphine – as an opioid base often mixed with methamphetamine or acetaminophen.[1] The bright color of the product may appeal to children and poses a public health hazard. The Drug Enforcement Administration (DEA) has reported an uptick in these "rainbow fentanyl" products, which often resemble prescription medications.[2] In July, 2024, over 23 kg (50 pounds) of purple fentanyl powder was seized from 2 vehicles crossing from Mexico to the United States.[3] While this is only one example, it illustrates the increase in production and need for greater awareness and understanding. In this case report, we focus on the brorphine component of purple fentanyl, as it is a relatively new substance for many clinicians in emergency medicine.

Brorphine is a Schedule I substance with no identified therapeutic use in the United States.[4] It is considered a novel potent opioid (NPO),[5] which are illicit synthetic nonfentanyl compounds introduced to the drug market with increasing frequency in recent years. The motivation to produce NPOs is unclear, but they may have become more popular due to demand for increased potency. Brorphine has been found as both a single agent and in combination with heroin or fentanyl.[6]

CASE PRESENTATION

A 33-year-old male was brought to the emergency department (ED) at our institution by an unknown party in a private vehicle. He had miosis (pinpoint pupils), clammy skin, and was minimally responsive to a sternal rub. Opioid toxicity was suspected; therefore 2 mg of intranasal naloxone was administered. The patient became more responsive and was able to answer some questions but repeatedly stated that the purple fentanyl he had taken must have been stronger than he thought. He began scratching his arms and torso and hitting his head against the wall after naloxone administration. He also exhibited slowed cognition.

Pertinent past medical history included hepatitis C, generalized

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Table 1. Vitals and Laboratory Values

Blood pressure	156/86 mmHg	Calcium	9.3 mg/dL
Sodium	140 mmol/L	Temperature	98 °F
Heart rate	87 beats per minute	White blood cell count	7.6 K/mcL
Potassium	4.1 mmol/L	AST	98 units/L
Respiratory rate	18	Hemoglobin	14.4 g/dL
Creatine	0.82 mg/dL	ALT	79 units/L
SpO_2	95%	Platelets	268 K/mcL

Abbreviations: AST, aspartate aminotransferase; ALT, alanine aminotransferase; SpO_2, peripheral oxygen saturation.

anxiety, and intravenous drug use. He had an allergy to codeine, reporting a reaction of hives and shortness of breath. At the time of presentation, he weighed 91 kg and was 1.75 m tall. Home medications included citalopram 20 mg daily and olanzapine 10 mg nightly. The electrocardiogram was nonischemic, and he was monitored on telemetry without evidence of arrhythmia. There was no leukocytosis, anemia, electrolyte abnormality, or change in kidney function. Laboratory results were notable for elevated liver enzyme levels. The patient reported a history of hepatitis C but was not receiving treatment. Pertinent vital signs and laboratory results are listed in Table 1. His urine drug screen was positive for fentanyl, amphetamines, cocaine, and opiates. Naloxone was repeated as needed, and he was admitted for observation. At the time, no ED staff were familiar with purple fentanyl and how it might differ from other opioid-containing drugs.

DISCUSSION

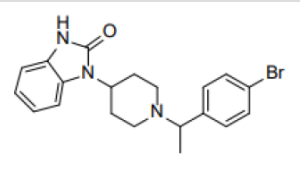
Analytical labs in Europe and the United States have found that positive drug samples containing brorphine are frequently adulterated with other substances, including fentanyl, flualprazolam, cocaine, methamphetamine, tramadol, diphenhydramine, and isotonitazene.[7] Common methods of administration include injection, smoking, snorting, and oral consumption. Pharmacology details are shown in Table 2.

The substance is sold under various names, including purple fentanyl, purple heroin, and purple meth; however, the product may not contain the compounds listed in its name. A report on a series of deaths in the Midwestern United States indicated that a typical user was an adult man with a mean age of 52.[8] This report also highlights that standard screening tests do not detect brorphine, and specialized testing may be required. Illicit substances lack standardized quality control, so the amount of brorphine in different batches can vary substantially.

The unique color of these products may appeal to children, which is concerning because the lethal dose would be much lower than for adults. Although brorphine historically has been identified in middle-aged adults, these color formulations could entice younger populations to experiment. Given the potency of brorphine, even a small ingestion could be fatal in children.

Brorphine is structurally similar to fentanyl.[9] The exact half-life is unknown, but case data demonstrate detectable blood concentrations up to 60 hours after oral ingestion. A patient in 1 report described prolonged euphoria and more intense withdrawal cravings compared with heroin. Pharmacokinetic studies show that it is a potent activator of the μ-opioid receptor, with less activity at the κ-opioid receptor.[10]

Table 2. Brorphine Pharmacology

Mechanism of action	Agonist at the μ-opioid receptor; causes typical effects found with opioid compounds (eg, euphoria, dizziness, loss of consciousness, respiratory depression)[6]
Structure	 • Synthetic opioid with a benzimidazole group that prevents it being regulated as a fentanyl analog[7] • Can be found as a hydrochloride salt, which is water soluble[6]
IUPAC name	1-{1-[1-(4-Bromophenyl)ethyl]piperidin-4- yl}-1,3-dihydro-2H-benzimidazol-2-one
Molecular formula	$C_{20}H_{22}BrN_3O$
Molecular weight	400.32 g/mol
Schedule	• Schedule I controlled substance in the United States • 12 times more potent than morphine[4]
Pharmacokinetics	Brorphine was still detected in a serum sample analyzed 60 hours after admission to a medical facility[9]

Management of Brorphine Overdose

Signs and Symptoms

Patients may present with an opioid toxidrome, including respiratory depression, sedation, unresponsiveness, and miosis.[11] Other reported symptoms include itching and seizures. Case reports also describe rhabdomyolysis and acute kidney injury in patients with detected brorphine levels.[8] Given the polysubstance exposure typically seen in brorphine-containing mixtures, signs of amphetamine overdose also may occur, including anxiety, agitation, hallucinations, hyperthermia, diaphoresis, mydriasis, and seizures.[11] If these substances are co-ingested, the clinical presentation may be confusing due to opposing toxidromes. In 2022, Glidden et al reported that opioid plus methamphetamine exposures resulted in a sympathomimetic toxidrome in 31% of cases and an opioid toxidrome with 32.9% of cases.[12] Common clinical findings included tachycardia (16.1%), bradypnea (11.6%), respiratory depression (26.5%), central nervous system (CNS) stimulation (52.9%), coma/CNS depression (46.5%), acute kidney injury (7.7%), and rhabdomyolysis (16.1%).

Diagnosis

Definitive diagnosis of brorphine overdose requires testing at a lab that can perform an enzyme-linked immunosorbent assay capable

of detecting NPOs.[10] Brorphine can be detected in blood and urine; however, these samples must be sent to specialized facilities, and results may take days.

Clinical diagnosis should not be delayed pending laboratory confirmation and can be based on history, presentation, physical examination, and findings consistent with opioid toxicity (eg, respiratory depression, miosis, clammy skin, seizures, delirium, and bradycardia).

Treatment

Initial management includes ensuring any immediate complications are managed (eg, stabilization of airway, breathing, and circulation). If an opioid toxidrome is suspected, prompt administration of naloxone is recommended and should be repeated as needed until the patient is stable. Because the half-life of brorphine is not well-defined and may be prolonged, patients should be monitored for 12 to 24 hours after stabilization.[13]

In this case, the patient responded to an initial dose of naloxone, allowing for further history regarding substance use. He required additional doses to maintain alertness and ultimately left the ED against medical advice. Based on urine and drug screening results, we suspect ingestion of fentanyl, brorphine, and amphetamines. Confirmatory testing was not performed because it was not available at our institution. Patient self-report of ingested substances is uncommon; thus diagnosis is typically based on clinical presentation rather than history alone.

Awareness of brorphine and other NPO compounds can help clinicians manage these cases effectively. Recent DEA statistics indicate that more than 107 000 Americans died from drug poisoning or overdose in 2023, with nearly 70% involving opioids.[14] Approximately 2 mg of fentanyl is considered potentially lethal, whereas the lethal dose of brorphine remains unknown. Alone or when in combination with other substances, even small amounts can be fatal. Rainbow-colored pills and powders are becoming increasingly prevalent and may contribute to rising overdose rates, particularly among younger populations.

CONCLUSIONS

Awareness of NPOs is critical for ED clinicians. Brorphine is one of many substances currently being manufactured and distributed. Prompt recognition of opioid toxicity and consideration of co-ingestants not detected on routine screening are essential for appropriate and timely treatment. Improved knowledge will help clinicians remain vigilant and prepared for emerging drug threats.

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