Reining It In

Xylazine Overdose

LESSON 10




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Objectives

On completion of this lesson, you should be able to:

1. Describe the current epidemiology of xylazine exposures in the United States.
2. Recognize xylazine overdoses.
3. Manage xylazine overdoses.
4. Discuss therapeutic options for patients in suspected xylazine withdrawal.
5. Treat xylazine-associated wounds.
6. Apply principles of harm reduction in cases of xylazine exposure.

From the EM Model

14.0 Psychobehavioral Disorders
- 14.1 Substance Use Disorders

17.0 Toxicologic Disorders
- 17.1 Drug and Chemical Classes
  - 17.1.2 Analgesics
  - 17.1.24 Recreational Drugs
  - 17.1.25 Sedatives/Hypnotics

CRITICAL DECISIONS

- In what patient populations should xylazine exposure be considered?
- How should xylazine-fentanyl overdoses be managed?
- What treatment options exist for xylazine withdrawal?
- What do xylazine-associated wounds look like and how are they managed?
- What harm reduction practices affect the care of patients who have overdosed on xylazine?

Xylazine, a veterinary sedative and α2 agonist, is increasingly prevalent in the unregulated drug supply. In some areas of the United States, it is reported to be present in most opioids that are acquired illicitly. Emergency physicians must be prepared to treat patients who are exposed to xylazine and related chemicals, such as medetomidine, and must understand the consequences of emerging drugs in the overdose epidemic.

CASE PRESENTATIONS

CASE ONE

A 24-year-old woman is brought in via ambulance after a suspected opioid overdose. The paramedics report that the patient was bradypneic when they arrived on scene, had pinpoint pupils, and was found with a syringe. A bystander reported that the patient had just used "tranq dope." The paramedics gave the patient naloxone 4 mg IN; her respiratory rate increased, but she remained sedated during transport. The patient's vital signs on arrival include BP 112/55, P 65, and R 10; SpO_2 is 93% on room air. She has pinpoint pupils and responds only to a sternal rub. She is placed on end-tidal CO_2 monitoring and observed in the emergency department.

CASE TWO

A 43-year-old man with a medical history of OUD presents with nausea, body aches, anxiety, and diarrhea. The patient reports that he last used opioids 2 days ago before he ran out of money. He also reports that over the past few months, he has been going to a new dealer who has been selling him fentanyl that "knocks me out for longer than usual." The patient is willing to try a medication to help him quit using illicit opioids. On examination, he is yawning frequently and has piloerection. His COWS score is calculated at 15. He is given buprenorphine 8 mg SL and reports that his withdrawal has improved, but he still feels anxious and restless.

CASE THREE

A 30-year-old man with a medical history of OUD, cocaine use disorder, and hepatitis C is brought in by a roommate who is concerned about the appearance of a wound on the patient's forearm. The patient states that he noticed a small, dark circle on his left forearm a month ago but thought it was from a fall. He says the dark circle has increased in size and turned from dark purple to black over the past few weeks, and it has now become more painful to use his left hand. The patient states that he always uses drugs intravenously. On physical examination, a large necrotic wound is seen over the extensor surface of the patient's left forearm, without exposed tendon. There is no fluctuance or crepitus. The patient is afebrile and has a normal heart rate and blood pressure. The patient and his roommate say they have heard that people with wounds like this have needed amputations.

Introduction

Xylazine, a veterinary sedative used for procedural sedation and anesthesia, is an α2 agonist with structural similarity to dexmedetomidine.[1] Because of adverse effects, xylazine was not approved for human use when it was studied as a sedative agent.[1] Prior to 2007, much of the published literature on xylazine exposure in humans came from case reports of self-harm attempts among people who worked in veterinary settings.[2] Xylazine began to appear sporadically in the unregulated opioid supply in Puerto Rico and Philadelphia in the mid-2000s and has since increased in prevalence across the United States.[3,4] In some areas of the country, xylazine is present in the majority of illicit opioid samples tested.[5] The emergence and expansion of xylazine have raised concerns for a harmful, synergistic pharmacologic effect when the drug is combined with fentanyl. Xylazine exposure can occur through oral, inhalational, intranasal, and injection routes, and its duration of action is between 4 and 8 hours. There have also been reports of distinct wounds associated with injection of drugs that are adulterated with xylazine.

CRITICAL DECISION

In what patient populations should xylazine exposure be considered?

Xylazine was first detected in the unregulated drug supply in Puerto Rico through testing of returned needles at a syringe exchange and through postmortem forensic toxicologic studies of fatal overdoses.[3,4] More recently, xylazine appeared in Philadelphia and has been increasingly detected in other areas across the United States.[4,6] Thus, many patients across the country who use unregulated drugs may be exposed to xylazine. A study of overdose deaths reported that xylazine was found in decedents in 43 states from 2019 to 2022.[7] Xylazine is essentially always accompanied by highly potent synthetic opioids such as fentanyl, with one study reporting 99.1% of all xylazine-associated decedents also had detectable fentanyl or fentanyl analogues.[6] The same study reported that in 21 jurisdictions that performed postmortem xylazine testing in June 2022, the drug was detected in 10.9% of fentanyl overdose fatalities, with significant regional variation.[6] The detection of xylazine by postmortem testing indicates that the decedents were exposed to the drug, but it does not prove that the drug caused their deaths. The rising prevalence of xylazine in postmortem test results is consistent with its increasing prevalence in the illicit fentanyl supply.[6] One Drug Enforcement Administration report stated that xylazine

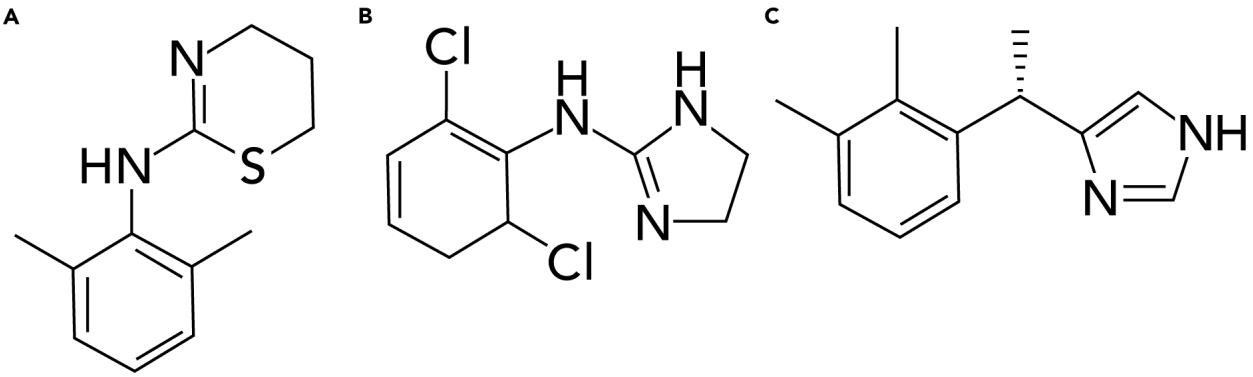

FIGURE 1. Structure of xylazine (*A*), clonidine (*B*), and dexmedetomidine (*C*). *Credit:* Vaccinationist (Public Domain [https://creativecommons.org/public-domain/pdm/]; https://commons.wikimedia.org/wiki/File:Xylazine.svg), Ayacop (Public Domain [https://creativecommons.org/public-domain/pdm/]; https://commons.wikimedia.org/wiki/File:Clonidine.svg), Icey (Public Domain [https://creativecommons.org/public-domain/pdm/]; https://commons.wikimedia.org/wiki/File:Dexmedetomidine.svg).

is present in 23% of all illicitly manufactured fentanyl, although with substantial geographic variation.[8] The combination of xylazine and fentanyl is often referred to by the slang terms *tranq* and *tranq dope*.[4]

It is unclear why xylazine is added to unregulated opioids, but adulteration is believed to occur at the local level.[8] Some speculate that it enhances, speeds up, or prolongs the sedative effects of opioids. It has been reported that some people who use drugs may seek out xylazine after getting used to its prolonged sedative effects.[4,8,9] Xylazine has also been found mixed with other drugs, including methamphetamine and cocaine, although at a lower prevalence than with fentanyl.[10] Although the epidemiology of xylazine in the unregulated drug supply is likely to keep changing, xylazine exposure is currently most likely in people who use fentanyl. Public health alerts have been issued about the emergence of another potent α2 agonist and veterinary sedative in the illicit drug supply, medetomidine. The implications of this emergence on the drug supply and people who use drugs are unknown at this time.[11] Emergency physicians must be aware of the clinical consequences of exposure to xylazine (and related substances) in patients who use xylazine-adulterated drugs.

CRITICAL DECISION

How should xylazine-fentanyl overdoses be managed?

Understanding the pharmacology of xylazine is important to the management of xylazine in overdose. As described above, xylazine is primarily an α2-receptor agonist, which is responsible for its sedative effect. Xylazine has been compared with other α2 agonists, such as dexmedetomidine and clonidine, with important differences noted.[1,8] Xylazine, clonidine, and dexmedetomidine are all agonists at both the imidazoline receptor and the α2 receptor (*Figure 1*).[8] The blending of effects at the imidazoline and α2 receptors confers different properties between these drugs and results in different clinical findings. Agonist activity at the imidazoline receptor contributes more significantly to hypotension and bradycardia, whereas agonist activity at the α2 receptor causes sedation.[12] Dexmedetomidine is eight times more selective than clonidine for the α2 receptor and, consequently, causes less profound bradycardia and hypotension than clonidine.[12] In animal studies, xylazine appears to be more selective for the α2 receptor than the imidazoline receptor, so it may be more similar to dexmedetomidine.[13] Medetomidine is the racemic mixture of dexmedetomidine and levomedetomidine. Its clinical effects and management are likely similar to those of xylazine, but more research is needed into how medetomidine may differ from xylazine.[11]

Some understanding of xylazine's effects on humans is derived from older case reports of its use in self-harm attempts and drug-facilitated crime. In these reports, xylazine was used in a wide range of doses and was found to cause deep sedation.[1] These case reports described xylazine's hemodynamic effects such as hypertension, hypotension, bradycardia, and respiratory depression, but most cases involved large doses that were administered intravenously.

✔ Pearls

- Xylazine is an α2 agonist and can cause sedation after injection or ingestion, but it likely causes less profound hemodynamic effects than other α2 agonists, such as clonidine.
- Xylazine exposure almost always co-occurs with unregulated use of opioids, such as fentanyl.
- Xylazine-associated wounds can improve with diligent wound care.

It is unclear from current studies whether patients exposed to xylazine combined with fentanyl, a more common emergency department presentation of xylazine exposure, have more profound bradycardia or respiratory depression than patients exposed to fentanyl alone.[1,8,14] An observational study of patients with suspected opioid overdose reported that patients whose serum test results are positive for xylazine are less likely to require CPR or present in cardiac arrest than patients whose results are negative.[14] One explanation for this finding is that there are smaller quantities of fentanyl in drug cocktails that contain xylazine. Because opioids such as fentanyl are more potent respiratory depressants than xylazine, replacing fentanyl with xylazine may reduce the risk of respiratory arrest.[14]

Because several drugs or adulterants may be combined, patients who use unregulated drugs may present with overlapping toxidromes. For example, in the current era, patients with xylazine overdose are almost always co-exposed to fentanyl. Clinically significant respiratory depression from a xylazine-fentanyl overdose is primarily from fentanyl and will respond to naloxone.[8] The primary indication for naloxone is profound respiratory depression. It is the treatment of choice for patients with xylazine-fentanyl overdoses and should be dosed similarly to its use in other opioid overdose situations that emergency physicians manage: at the lowest effective dose that maintains adequate breathing.[8] Using awakening as an end point for naloxone dose titration is inappropriate and can lead to overadministration and precipitated withdrawal.[8] Patients with a suspected xylazine-fentanyl overdose may need pulse oximetry and capnography to ensure that respiratory depression does not recur or worsen. Depending on their clinical presentation and other co-exposures, these patients may also need supportive measures such as supplemental oxygen, intravenous fluids, vasopressors, or even mechanical ventilation.

No specific xylazine reversal agent is available for human use, although some α2 antagonists like yohimbine and tolazoline have been suggested because of experience with these agents in animals. However, they have not been studied or approved for this indication in humans, and their use has been associated with adverse effects such as tachycardia, hypertension, and arrythmias.[8,15] Atipamezole, an α2 antagonist approved for reversal of medetomidine sedation in veterinary practice, has not been studied or approved for human use.[8]

Although the emergence of xylazine in the unregulated drug supply is concerning, the narrative that xylazine leads to overdoses that are unresponsive to naloxone may discourage emergency physicians and bystanders from giving naloxone when it is needed. Concern for overdoses that are unresponsive to traditional naloxone dosing has also led some to propose using higher-dose preparations of naloxone or other longer-acting opioid antagonists, such as nalmefene, despite a lack of clinical data to show that this step is necessary. Xylazine itself is, indeed, unresponsive to naloxone, but naloxone remains critical to reversing the concomitant, life-threatening fentanyl-induced respiratory depression. Emergency physicians can always consult with a regional poison control center or medical toxicologist for management advice or assistance.

CRITICAL DECISION

What treatment options exist for xylazine withdrawal?

It is unclear whether a distinct xylazine withdrawal syndrome exists, but some patients have reported symptoms such as anxiety, cravings, and restlessness that they attribute to xylazine withdrawal.[9] Because xylazine is used with other drugs (mostly opioids), patients should be treated primarily for withdrawal from those substances. For example, patients with opioid use disorder (OUD) should be started on buprenorphine or methadone to treat their opioid withdrawal. In the era of fentanyl in the opioid supply, initiation of medications for OUD (MOUD) is more challenging.[16] In response, physicians have developed additional protocols to initiate buprenorphine using either a low-dose (microdosing) or high-dose (macrodosing) strategy.[16]

Given the increasing prevalence of polysubstance use, patients with OUD may also have other substance use disorders, including use of benzodiazepines, alcohol, and stimulants, and can experience withdrawal or discontinuation syndromes from those substances. Differentiating the various potential etiologies in these patients can pose a diagnostic challenge. Emergency physicians must look for objective signs and symptoms of known withdrawal syndromes. In patients who report cessation of drug use, piloerection, dilated pupils, yawning, vomiting, and diarrhea should prompt treatment of opioid withdrawal with buprenorphine or methadone. The severity of opioid withdrawal can be quantified using the Clinical Opiate Withdrawal Scale (COWS) score. Tremor, tachycardia, seizures, and hallucinations should prompt treatment of alcohol or

✕ Pitfalls

- Failing to administer naloxone in patients with suspected xylazine overdose and significant respiratory depression.
- Neglecting to offer MOUD to patients who use xylazine and complain of withdrawal symptoms.
- Missing signs of systemic infection in patients with xylazine-associated wounds.

benzodiazepine withdrawal. If withdrawal from an underlying substance has been adequately treated and patients continue to complain of cravings, anxiety, and restlessness, xylazine withdrawal should be considered.

In a case report, a patient with OUD who reported frequent xylazine use described restlessness, rigors, and dysphoria that the patient attributed to xylazine withdrawal. In addition to buprenorphine, the patient was treated with several agents that are occasionally used as adjuncts to treat opioid withdrawal, with the reported goal of treating symptoms attributed to xylazine withdrawal.[17] Tizanidine, lofexidine, and guanfacine are all oral α2 agonists that can be used to manage xylazine withdrawal if a patient is not significantly improving after standard opioid withdrawal management.[8] Although there is pharmacologic overlap between xylazine and these agents, the need to address xylazine withdrawal — and the efficacy, safety, dosing, and timing of these medications — remains unstudied and unclear. Other α2 agonists (eg, clonidine) may also be helpful adjuncts in treating opioid withdrawal, and their use could serve a dual purpose by treating xylazine withdrawal, if it is truly a distinct clinical entity.[17] Regardless, patients being discharged, whether from the emergency department or after a hospital admission, should be provided with MOUD and have a follow-up appointment in place with an addiction medicine specialist who can manage pharmacologic and nonpharmacologic therapies.[8]

CRITICAL DECISION

What do xylazine-associated wounds look like and how are they managed?

Some early reports of xylazine adulteration of the opioid supply in Puerto Rico describe distinct wounds with open ulceration after injection.[2] Later ethnographic reports of people who use drugs described an increased incidence of necrotic skin wounds as the prevalence of xylazine in the drug supply increased.[4] The popular media has also raised alarms about an association between xylazine use and chronic skin wounds.[18] The appearance of these skin wounds has led some people to refer to xylazine as *the zombie drug* and the people with these wounds as *zombies*. This language perpetuates stigma against people who use drugs and exacerbates biases these patients may face in health care settings.[19] Stigma in health care may deter patients from seeking medical care when they need it.[19]

Many methods have been postulated to explain why xylazine could cause skin ulcers (*Figure 2*). As an α agonist, xylazine may cause vasoconstriction, which can cause local tissue hypoxia and injury.[17] Xylazine may also enhance the sedating effects of opioids, which can cause prolonged immobility that leads to pressure ulcers.[4] Xylazine decreases skin oxygenation and causes hyperglycemia in animal models, which are two mechanisms that can contribute to poor wound healing.[20,21] However, the relevance of these effects in humans is unstudied. Unstable housing, poor hygiene, and food insecurity are also common in this patient population and likely contribute to poor wound healing.[19] Other postulated mechanisms by which xylazine use could lead to chronic wounds include a direct cytotoxic effect, vasculitis, other adulterants in the drug supply, and bacterial contamination of needles, but definitive evidence is lacking.[8] There are reports of people who develop wounds at sites where they do not inject drugs and of wounds in people who report

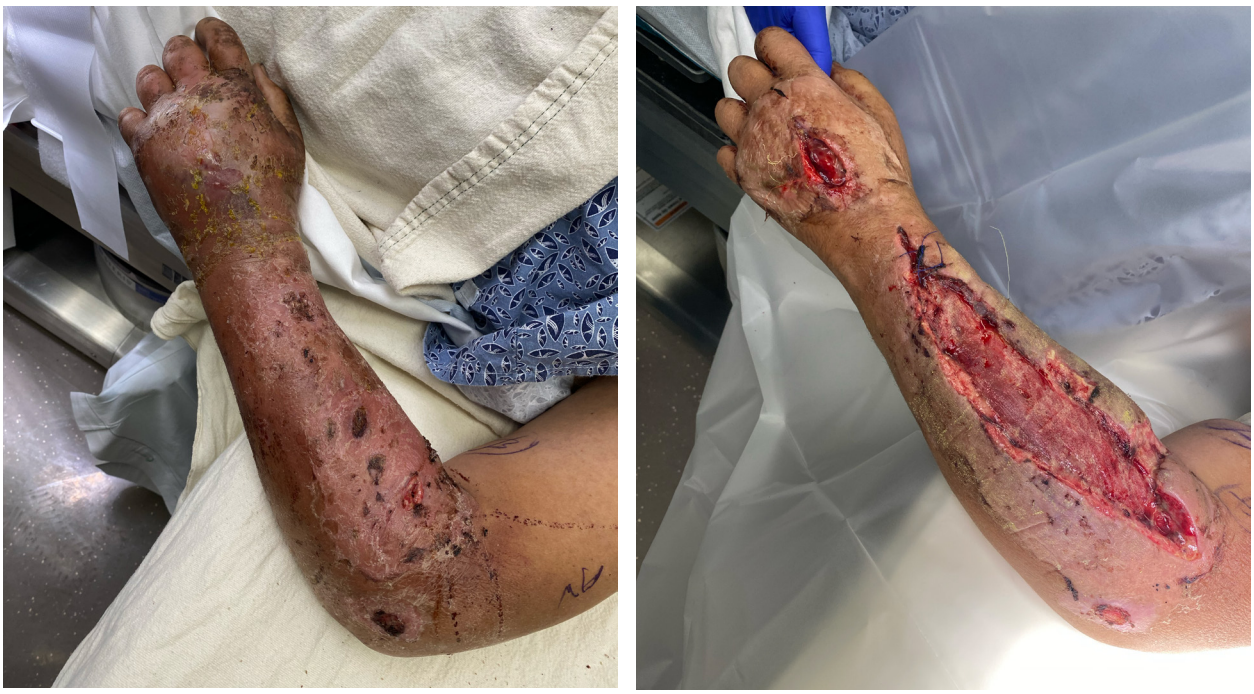

FIGURE 2. Progression of wounds in patient who uses xylazine. *Credit*: Christian Tomaszewski, MD, MS, MBA.

only intranasal drug use.[9,17,19] Whether these wounds are truly unique to xylazine has been questioned because intravenous drug use has always carried the risk of skin and soft-tissue infection.[22]

Xylazine-associated wounds have been described as having a unique progression and appearance (see *Figure 2*).[19] The wounds typically start as dark blisters over intact skin, often on the extensor surfaces of the extremities.[19,23] Over several days, these blisters enlarge or coalesce and form a large ulcer. The ulcer often develops a black eschar over some areas; meanwhile, other areas may retain viable tissue. The ulceration may be deep and expose muscle, tendons, and bone.[19,23] These wounds may lack classic signs of infection. If left untreated, they may develop infections secondary to compromised tissue.[19]

Wound care and cessation of drug use are the cornerstones of wound healing. Although data are lacking to guide wound management, emergency physicians must apply a few key principles. A thorough history and physical examination should be performed to assess for acute complications such as abscesses, cellulitis, or systemic infection. Any acute change in the wound that would have led to the emergency department presentation should be determined. Signs and symptoms of local or systemic infection may include expanding erythema around the wound, purulent drainage, fever, and tachycardia. Obtaining a CBC (to assess for leukocytosis), lactic acid levels, and levels of inflammatory markers such as a procalcitonin or C-reactive protein should be considered based on the severity of the wound. Blood cultures can be ordered to check for systemic infection. Plain x-rays can be ordered to check for needle foreign bodies in the wound, the presence of gas of early necrotizing infection, and bone changes of late osteomyelitis. An MRI or a bone biopsy should also be included as part of the workup for osteomyelitis, depending on the wound's severity.

A case series of patients with self-reported xylazine use noted histopathologic punch biopsy results that showed nonspecific inflammation and negative serum test results for vasculitis.[24] Although many xylazine-associated wounds likely do not require comprehensive blood work, imaging, or specialist consultation in the emergency department, these measures may be necessary if the diagnosis is uncertain, wounds are severe, or morbidity is expected.[23]

Management is mainly supportive and includes pain control, wound care, and selective use of either topical or systemic antibiotics.[8] Debridement of nonviable tissue promotes the healing of healthy tissue.[19] Successful nonsurgical management of xylazine wounds at a low-barrier outpatient wound clinic has been reported. Less invasive ways of debriding nonviable tissue include enzymatic debridement (with agents like collagenase), autolytic debridement (which enhances moisture to promote the body's own breakdown of necrotic tissue), or mechanical debridement (with wet-to-dry dressings). Mechanical debridement with wet-to-dry dressings may be painful in patients with opioid-induced hyperalgesia. A stepwise approach to nonsurgical management has been proposed (*Table 1*).[19]

How to Manage Xylazine-Associated Wounds
1. Premedicate with analgesics as needed.
2. Remove soiled dressings.
3. Clean wounds with saline or wound washes to remove nonviable tissue.
4. Debride with topic autolytic or enzymatic agents.
5. Apply topical agents, such as skin sealant, to protect the wound area and topical antibiotics if needed.
6. Apply a nonadherent primary dressing.
7. Apply a secondary absorbent layer.
8. Secure the dressing with gauze.

TABLE 1. Stepwise management of xylazine-associated wounds[19]

Surgical debridement may be necessary for advanced wounds. In rare cases, amputation may be necessary for wounds that have compromised a limb.[18] Although the optimal timing is unknown, tissue grafting and wound closure may be needed for severe wounds. These interventions should be considered in consultation with plastic or general surgery.[23]

The disposition of patients with xylazine-associated wounds may pose a challenge in the emergency department. Wound severity and chronicity, concurrent medical issues, and access to outpatient wound care options should all factor into deciding whether patients can be safely discharged. Housing insecurity is common in this patient population, which can make daily dressing changes and wound hygiene challenging. Substance use treatment facilities may be unable to care for patients with complex wounds. Acute medical rehabilitation facilities that can manage wounds may be unfamiliar with or unwilling to manage MOUD. Syringe exchange programs may offer low-barrier wound care clinics.[19] Burn centers may be needed for wound management in severe cases.

CRITICAL DECISION

What harm reduction practices affect the care of patients who have overdosed on xylazine?

Patients with substance use disorders present to the emergency department with varying readiness to stop or reduce their drug use. Although some patients want to start MOUD and stop all unregulated opioid use, other patients will not have drug abstinence as their immediate goal. Emergency physicians can still help these patients reduce harm from illicit drug use. Harm reduction is a range of intentional practices aimed at reducing the negative consequences of risky behaviors, including drug use. Harm reduction methods can be applicable to the care of emergency department patients who use fentanyl

that contains xylazine or other sedatives. If available in the emergency department, these patients should consult with a substance use navigator or other drug treatment specialist prior to discharge. Other strategies such as take-home naloxone, drug checking, syringe exchange programs, and safe consumption sites may be helpful as well.

Take-Home Naloxone

Providing patients with take-home naloxone at discharge has been proposed as a method to reduce the risk of fatal overdose in the community.[25] Although patients cannot self-administer naloxone when they have overdosed, providing take-home naloxone increases the availability of naloxone in the community so that someone they know can administer naloxone to them to reverse their opioid overdose or so that they can administer naloxone to someone else in need of it. Giving patients naloxone, not just prescriptions to be filled later, results in high rates of carrying naloxone in the weeks after discharge.[25]

Drug Checking

Drug checking is the practice of testing a small drug sample for the presence of specific substances.[26] Individual state laws may regulate the legality of drug checking. A xylazine drug-checking program in Rhode Island demonstrated the feasibility of community-based drug checking.[27] Whether drug-checking programs change patient behavior in a way that reduces overdoses is unknown, and the value of the program remains unclear. However, an understanding of the prevalence of xylazine in the local drug supply may help educate patients and empower them to make informed choices about how they use drugs.[27]

Syringe Exchange Programs and Safe Consumption Sites

Syringe exchange programs and safe consumption sites have been developed to reduce harm related to drug use. In addition to disposing of used needles and providing clean ones, syringe exchange programs and safe consumption sites sometimes offer additional services. These services can include wound care, which may be particularly helpful for patients with xylazine-associated wounds who need free or low-cost care.[19] Referral to a syringe exchange program may be a way for emergency physicians to connect patients with outpatient wound care services.

Summary

Xylazine is an α2-receptor agonist that is increasingly present in the unregulated opioid supply. Other α2-receptor agonists, like medetomidine, are also found in illicit drugs. Xylazine use is almost always associated with fentanyl use — isolated xylazine overdose is rare. Xylazine-fentanyl overdose is diagnosed clinically and likely presents as prolonged sedation due to the xylazine component. The key management steps for patients with suspected xylazine overdose are to administer naloxone for maintaining adequate ventilation and to monitor patients until their mental status improves. Although it is unclear whether xylazine withdrawal is a distinct clinical entity, the addition of an α2 agonist such as clonidine or tizanidine should be considered in patients who have been adequately treated with MOUD but still report anxiety and restlessness. Patients with xylazine-associated wounds should be assessed for any acute infection and treated according to wound severity. Wounds with extensive areas of necrosis may require inpatient admission and surgical debridement, but most can be managed nonsurgically. Emergency physicians can help reduce harm associated with xylazine use by providing patients with take-home naloxone and consultations with substance use navigators. Low-barrier harm reduction agencies such as syringe exchange programs are valuable resources for patients to be aware of at discharge.

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CASE RESOLUTIONS

CASE ONE

The patient experienced an overdose secondary to fentanyl and xylazine use. Her fentanyl-induced respiratory depression was reversed by naloxone. About 40 minutes later, the patient's respiratory depression worsened to a respiratory rate of 4 bpm, and her end-tidal CO_2 level rose to 80 mm Hg. She was given another 0.04 mg IV of naloxone and subsequently had improvement in her respiratory rate and end-tidal CO_2 level. The patient remained sedated and minimally responsive to voice from the residual effects of xylazine and fentanyl. The patient gradually woke up, and various treatment options to mitigate unregulated opioid use were discussed with her. Low-dose buprenorphine was initiated. The patient was discharged with a 7-day prescription for buprenorphine and a follow-up appointment with addiction medicine in 2 days.

CASE TWO

There was concern for ongoing opioid withdrawal, and the patient's COWS score was recalculated at 9. He was given another 8 mg SL of buprenorphine. He was also given tizanidine 1 mg as an adjunct in case some of his symptoms were related to xylazine withdrawal. The patient reported that his symptoms had improved enough that he wanted to be discharged. He was discharged with a prescription for buprenorphine and instructions to follow up at a local walk-in mobile clinic that treats patients with substance use disorders.

CASE THREE

The patient's wounds were found to be consistent with xylazine use. His WBC count on a CBC was normal, and an x-ray of the forearm revealed no subcutaneous free air. Although the patient's wounds were determined to be at low risk of acute infection, the patient was placed in an observation unit to continue trending his vital signs. While in the observation unit, the patient was started on methadone and was seen by a wound care specialist, who taught him to perform daily dressing changes.

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