Occupational methamphetamine manufacturing toxin exposure: An exposure example

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ABSTRACT

Purpose

To illustrate opportunities for pharmacists as resources for community-based healthcare professionals that may be at-risk for occupational exposure to toxins of illicit methamphetamine (METH) manufacturing while providing case management services to community-based patients.

Summary

Pharmacists can serve as a resource with education and protocol development for minimizing the hazards of healthcare professionals, including pharmacists, at-risk for exposure to the toxins of METH manufacturing while providing community-based case management. The illicit production of METH requires solvents for extraction and purification and often results in the release of a number of harmful, and potentially deadly, chemicals and gases. For community-based healthcare professionals, risk factors include direct contact and inhalation. Community-based healthcare professionals providing case management services to patients involved in the production of METH are at-risk for exposure. Examples of an occupational exposure and how the pharmacist can serve as a resource to these providers are provided.

Conclusions

When conducting home- or community-based services, healthcare professionals may inadvertently experience health-related consequences and injuries because of exposure to hazardous wastes created by and used in the production of METH. The pharmacist can provide education and protocol development to help healthcare professionals identify hazards of exposure to the toxins of the manufacturing of METH, identify signs and symptoms of METH use, and identify signs and symptoms of toxin exposure.

KEYWORDS

methamphetamine, occupational exposure, hazardous waste, pharmacist

INTRODUCTION

Illicit methamphetamine (METH) production occurs in a variety of locations including residences.[1] Injuries, primarily eye and respiratory tract irritations, have been reported by nurses and physicians working in the emergency department (ED) following exposure to substances remaining on patients after a METH production incident occurred.[2] Healthcare professionals who provide community- or home-based services may be at-risk for health-related exposure to the toxins in illicit METH production. These environmental dangers are often the result of substances present during explosions and fires or chemical burns from exposure and inhalation of aerosolized toxic substances.[3] Three fatalities have been reported secondary to phosphine gas exposure during the process of METH manufacturing.[4] This is important to note because the extent of toxin exposure in an environment, whether an active METH manufacturing site or not, is not known. Toxins can become re-aerosolized and particulate matter embedded in the environment.[5]

We describe one occupational exposure of healthcare professionals providing case management services and identify opportunities for pharmacists to help educate community-based providers. Pharmacists must be aware of the signs and symptoms of METH production exposure. Upon a review of the literature, no educational guidelines for healthcare professionals were found for those who have, or could, experience such exposure.

EXPOSURE REPORT

The Integrated Multidisciplinary Program of Assertive Community Treatment (IMPACT) team is a community- and academically-based program for persons diagnosed with a severe mental illness (SMI). For purposes of this commentary, healthcare professionals, including pharmacists and pharmacy students, are those healthcare professionals providing case management services to community-based patients with a diagnosis of a SMI.

This IMPACT team is comprised of a psychiatrist, psychiatry resident, team leader (Licensed Clinical Social Worker), assistant team leader (Licensed Professional Counselor), three case managers, one recovery support specialist, three nurses, an administrative assistant, and a clinical pharmacist. As part of the case management services, team members make assessments and follow-up visits to patient residences. Service recipient enrollment is limited to 75 persons. Criteria for patient enrollment is based on the Diagnostic and Statistical Manual of Mental Disorders, 4th edition, text revision (DSM-IV-TR) for adults with a primary diagnosis of schizophrenia, schizoaffective disorder, or bipolar disorder.[6] This clinical program provides continuous treatment, rehabilitation, and support services to persons with SMIs in settings that are natural to the service recipient. This program is based on the assertive community treatment (ACT) evidence-based model to address the needs of adults with SMI diagnoses.[7]

During a recent home visit, inadvertent occupational exposure to METH manufacturing was experienced by two IMPACT team members. The healthcare providers arrived at the residence for a follow-up visit and were invited into the residence. Within minutes of entering the home the team members noticed the presence of a brown residue on the flat surfaces and walls. There was a strong and noxious odor that caused eye, nose, and throat irritation. The healthcare providers also noted cleaning supplies, crystal drain cleaner, and empty 2-liter soda bottles with brown residue. As quickly as possible, the IMPACT team members moved all parties out of the apartment and into open air. Exposure irritation resolved within several hours without sequelae. No long-term inhalation consequences were identified or reported.

DISCUSSION

A literature search was conducted for peer-reviewed articles on exposure to toxins produced secondary to METH manufacturing. Databases searched included Ovid, Google Scholar, MEDLINE, and PubMed (all 1965 to January 2013) using search terms clinical practice guidelines, health workers, occupational exposure, methamphetamine, clandestine laboratories, inhalation exposure, shake and bake, and hazardous substances. The search was limited to studies published in English. References from publications identified by these criteria were reviewed for inclusion. Articles identifying specific contact or inhalation hazards are reviewed.

A number of toxic, harmful, and potentially deadly chemicals and gases are created during the production of METH. Chemical exposure while treating patients involved in METH-related injuries can lead to injuries of healthcare personnel. Common exposure hazards found in residential METH labs occur in liquid, solid, and gas forms.[8] Exposure risks to eyes, the skin, and respiratory tract occur from gases and liquids, whereas exposures to solids mostly involve the skin and eyes.[8] Liquids used in production commonly include acetone, toluene, muriatic acid (hydrochloric acid), sulfuric acid, sodium hydroxide (lye), ethanol and isopropyl alcohol, naphtha (found in camper stove fuel/charcoal lighter), and chlorofluorocarbon.[8]

Gases released during METH production are known to cause respiratory symptoms and breathing difficulty.[1] In one study of investigators dealing with illicit laboratories (n=40), a sustained reduction in lung function, specifically forced expiratory volume, was found in 85% (34 of 40) of the investigators. The average reduction in lung function was rated as similar to that of continuing smokers (64 mL/year vs. 52.9 mL/year for men) although only 28% of the laboratory professionals were smokers.[9] Hazards found in gaseous form included ammonia, phosphine, hydrogen chloride/hydrochloric acid, hydrogen cyanide, and formaldehyde.[8]

Potential exposures in solid form include red phosphorous, lithium, iodine, fentanyl, aluminum chloride, sodium hydroxide, mercuric chloride, and lead.[8] In a controlled experiment to evaluate toxin spread following METH production using the red phosphorous method, the research was designed to determine [1] the distance from the production site and the amount of toxin(s) produced, [2] the presence of contaminants 24-hours post-production, and [3] the effect of normal activities to re-suspend particles 24-hours after the manufacturing process. Researchers found that manufacturing toxins, such as hydrochloric acid and iodine, spread throughout the rooms. These results were based on a test location of five rooms, all carpeted, totaling approximately 500 square feet. The impact of household activities, identified as walking, vacuuming, and furniture moving, were assessed in the area of the METH manufacturing and in other parts of the structure. The researchers found airborne spread of the manufacturing process remained 12 to 24 hours after four hours of METH processing. Contamination samples were higher closer to the manufacturing area compared to more remote areas. Contaminated surface levels remained high, as long as 18 hours post-production, and contaminant levels exceeded state and federal safety levels one month later.[5]

Symptoms of exposure included nausea and vomiting, lung irritation and shortness of breath, dizziness, headache, as well as rashes and chemical burns to the skin and/or eyes.[1,2] These symptoms were consistent with findings from the state poison control center.[10] Thrasher et al. used a descriptive study for a 5-year period (1999 through 2004) and reported persons actively involved in METH production were more likely to experience skin-related problems. Adverse respiratory and central nervous system (CNS) effects were the most frequently reported categories. The most common symptoms within each category (reported by adults) were headache (24%), nausea or vomiting (19%), dizziness (8%) for CNS-related adverse effects with breathing difficulties (8%) and cough (7%) for respiratory adverse effects. Eye irritation (7%) was the most commonly reported contact adverse effect. In addition, the researchers found the person's residence was the primary site for METH manufacturing.[11] It is important to note that neurologic symptoms (dizziness and headache) may not present immediately. Furthermore, respiratory symptoms may not present immediately either and once present, can persist for 10 weeks or longer.[10]

ROLE OF THE PHARMACIST

The pharmacist brings a variety of expertise to the healthcare team. The pharmacist can describe physical effects due to the products and provide potential health consequences of these effects. Pharmacists are also in a position to develop strategies to manage adverse effects, should they occur. Drug information related to METH labs can include signs and symptoms of METH use and exposure. The pharmacist can provide current evidence-based literature to help with decision-making and options to minimize exposure. Specific educational opportunities include visual inspection of the area, contact protection protocols, odor identification, and direct observation of individuals in the METH lab area.

The pharmacist can develop and provide educational content that would include recognizing:

METH manufacturing products and equipment: A list of commonly used items in METH production may include nail polish remover (acetone), rubbing alcohol, fertilizer, pseudoephedrine, pool supplies (hydrochloric acid), iodine crystals or flakes, kitty litter, matches or road flares (red phosphorous), rock salt, and gun cleaner. Equipment that may be present includes aluminum foil, coffee filters, jugs, bottles, plastic storage containers, buckets, measuring cups, funnels, pails and buckets, paper towels, rubber gloves, propane cylinders, tape, and strainers.[12] Often the trash of an active METH lab will include empty cans of paint thinner, antifreeze, drain cleaner, starter fluid, or brake fluid. One may also see boxes of salt, reddish stained coffee filters, broken lithium batteries or car batteries, empty match boxes, cold tablet packaging, and plastic bleach or soda bottles with holes or tubes at the top. Propane tanks or used camping fuel containers may be seen, too.

Signs and symptoms of METH use: Physical and behavioral effects are associated with METH use, particularly if exposure has been recent. Healthcare professionals providing community-based services might

encounter patients presenting with the following signs and symptoms: aggression, anxiety (which may include pacing), mydriasis, and tachypnea. Additional indicators of METH use include paranoia. The patient may complain of heart-related symptoms, such as palpitations.[13]

The duration of effects varies with the route of administration. In an experimental setting, the METH elimination half-life was approximately 11 hours if smoked.[14] When METH use ceases, the user may experience "tweaking," described as increasing anxiety, irritability, and an inability to concentrate. During this phase psychotic symptoms, such as hallucinations, and paranoia may present.[14]

The clinical presentation for recent use centers around excessive sympathomimetic activity with physical symptoms of increased heart and respiratory rates and blood pressure. An increase in energy and alertness may also be noted.[15] Following this period of excessive stimulation, withdrawal symptoms appear, characterized by depression, dysphoria, irritability, and hypersomnia. Depending on the duration of use, the depth of the dysphoria may lead to suicidal ideation.[15] The withdrawal syndrome associated with chronic use is characterized by more severe dysphoria and lethargy. Physical signs and symptoms of chronic use include severe dental problems with excessive caries and tooth erosion and loss, frequently referred to as "meth mouth" and motor impairments.[16] These include dyskinesias, athetoid and chorea movements, and Parkinsonism.[16]

The pharmacist can develop protocols to address potential exposure risk to METH manufacturing:

Recognition of odors: If noxious fumes or chemical odors are present, exposure has occurred. The severity of symptoms is related to the amount of chemical exposure. Primary intervention is to leave the area immediately, moving to open air. Several chemicals used in the METH production process create distinctive odors. Examples of odors include a sweet ether smell, acrid chemical fume, ammonia or cat urine odor, or rotten egg/sulfurous odor. These come from isopropyl alcohol (rubbing alcohol or isopropanol fuel treatment), ethyl alcohol (wood spirits), lye crystal, or liquid iodine crystal or liquid iodine mineral spirits, bleach (anhydrous ammonia), trichloroethane (gun cleaning solvent), sulfuric acid (car battery acid) hydrochloric acid, muriatic acid , white gas ether (starter fluid), and toluene. Individual material safety data sheets (MSDS) recommend immediately [1] flushing the eyes with large quantities of room temperature water for at least 15 minutes, [2] washing the affected area with soap and water for 15 minutes and removing clothing if saturated, and [3] moving to fresh air at once. Prompt medical attention and follow-up is strongly recommended. If a healthcare professional suspects exposure, but is uncertain, wash clothing immediately. A recent study found that METH-contaminated clothing can be decontaminated in one washing using medium agitation, warm water, and laundry detergent.[17] Taking a warm shower is encouraged.[1] A sample protocol is included.

Use of protective clothing: If exposure to METH lab toxins is suspected, recommendations to minimize the risk of exposure include wearing protective clothing, including long sleeves, long pants, and shoes that cover the entire foot, in addition to latex gloves.[9]

CONCLUSION

Healthcare professionals providing community-based case management services may find themselves exposed to METH production toxins. Such exposures can be hazardous and dangerous. Pharmacists can play an important role educating other healthcare professionals about common METH-related products and equipment, signs and symptoms of METH use, exposure hazards, and protocol development to minimize exposure risks.

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