Overview of Medical Toxicology and Potential for Exposures to Clandestine Drug Laboratories In California

Thomas J. Ferguson, MD., Ph.D.
Medical Director of Employee Health Services
University of California, Davis
Associate Clinical Professor, Internal Medicine
Consultant, UC Davis Regional Poison Control Center

Clandestine Drug Laboratories-Medical Considerations:

While it is reasonable to assume that exposure to illicit drug manufacturing operations is dangerous to children, there is little published literature regarding the relationship between exposure to i11icit drug laboratories and adverse health effects. This probably reflects the clandestine nature of these operations add the fact that little research has been performed to evaluate the health effects of living in such environments. However, I believe the empiric evidence alone is sufficient to state that children are at tremendous risk for injury (fires, electrocutions, other accidents) as well as illnesses from exposure to very dangerous and toxic chemicals used to manufacturing drugs (organic solvents, heavy meta1s, strong acids and alkalis).

These conclusions are supported by recent reports of entire families suffering burns and inhalationa1 injuries from fire in such environments and through my consultations with law enforcement agencies in Northern California. While it is evident that severe trauma is possible in these settings (deaths or injuries secondary to fires or explosions), it is most difficult to quantify the subtle neurologic injuries to children who have been exposed to solvents, heavy metals, and other toxic chemicals.

In order to understand potcntia1 fox pediatric injury in clandestine drug laboratory exposures, one should first review some general principles of pediatric poisonings. The literature regarding accidental poisoning indicates that approximately 70 percent of all poisonings involve children. Children under the age of 6 represent 85 percent of these pediatric poisoning cases. Several trends have been reported in pediatric poisonings: 1.The poisonings are invariably accidental and there is no suicide intent; 2. Pediatric poisonings typically involve only one substance; and, 3. The child is typically seen soon after the exposure.

Unfortunately these generalities may not apply to children exposed in a clandestine laboratory setting. For example, the caregivers in the drug laboratory environments may not be attentive to the exposure because of substance abuse. Furthermore the adults may not lx each to take the child for evaluation of possible illness because it may result in examination of the circumstance surrounding the exposure.

Pediatric patients have unique biological features that must be considered in determining risk. It is well documented that the developing central nervous system (CNS) of a child is much mom likely than an adult to be injured from exposure to certain toxins. In addition, the rapidly developing skeletal system of children is more likely to accumulate certain toxins (heavy metals). Gastrointestinal absorption of toxins may be different than that of an adult under similar circumstances. Finally, there are simply physical differences in the physiologic function of children that place them at increased risk for absorption of toxins (surface area to volume differences, increased respiratory rates, etc.). These concerns have been recently addressed by the federal EPA who recommend that when determining the potential of community risk of exposure to toxic hazardous waste, one must consider the unique susceptibility of the pediatric population.

Unfortunately for children living near clandestine drug laboratory operations, their potential for exposure to hazardous situations may not be recognized by their caregivers. It has been documented that a chaotic environment with poor supervision leads to increased risk for childhood poisoning. Furthermore, clandestine drug laboratory environments are likely to have poor adult role models and children in these environments are more likely to emulate the behavior of those around them. Finally, when injuries occur there may be delay in seeking help for the child since this could lead to scrutiny of the living situation by law enforcement.

The clandestine drug laboratory setting is much more likely to contribute to poisonings/exposures than a typical residential living situation because of the living conditions encountered in these environments. For example, it is not unusual to observe that drugs and chemicals in these illicit drug labs has been stored in unlabeled or inappropriately labeled food containers (methamphetamine solution in ”Snapple” bottles, solvents in soft drink containers, etc.). This situation is further exacerbated by the fact that these mislabeled food containers may be stored in food preparation areas or coven the refrigerator. Furthermore, the contamination of food preparation areas with drugs and chemicals likely leads to inadvertent consumption of chemicals.

In Northern California methamphetamine is the most common clandestine drug laboratory product. The production of methamphetamine typically involves reduction of the chemical ephedrine or a multiple step synthesis using phenyl-2-propanone as an intermediate. These drug manufacturing processes involve handling of strong acids (hydrochloric or hydriotic), strong base (lye), flammable and toxic solvents (methanol, ethanol, ethyl ether, hexane, or benzene), other toxic chemicals (palladium, phosphorous, iodine, and mercury) as well as drug intermediates (ephedrine, pseudoephedrine, phenyl- 2-pronanone, etc).

Potential for exposure may vary from a chemical preparation process isolated in a barn or outbuilding to processing in the kitchen of a single family home or apartment. I have reviewed depositions from children that indicate that drugs were manufactured in the kitchen where there was potential for cross contamination of food. Sometimes the children in the home wcre enlisted to help prepare these drugs. In one situation the unprotected children described assisting the respirator clad parents while being exposed to chemical fumes emanating from the ”cooking” of methamphetamine.

Exposure to ephedrine or other stimulant intermediates may lead to toxicity. Some methamphetamine absorption occurs through intact skin (probably accelerated by solvent mixtures) and has led to death of some adults during ”crank” preparation. Typically absorption of significant quantities of methamphetamine or other intermediates will cause rapid heart rate, hypertension, and can lead to an irregular cardiac rhythm. Following long term exposure these individuals may exhibit characteristic behaviors including self mutilation (”speed bugs”), bruxism (grinding of teeth), and m some circumstances seizure and death.

Solvent exposure can lead to immediate toxicity including intoxication, coma, and eventually death. Chronic exposure to high levels of the types of solvents used in drug laboratories can lead to chemical hepatitis, renal failure, neuropathy, and death. Exposure to concentrated acids or bases can lead to severe chemical bums, gastrointestinal injury, or eye injuries.

Iodine exposure is rather unique in that exposure to relatively small amounts of iodine (200 mg) has been associated with fatalities m children. Inhalation exposure to iodine fumes has lead to pulmonary edema and pneumonitis. Finally chronic exposure to iodine can lead to thyroid gland dysfunction.

Mercury salt exposure has been associated with severe gastrointestinal injury. Late manifestations of mercury exposure include a characteristic skin rash (acrodynia) and central nervous system toxicity. Contamination of enclosed environments such as a home with elemental mercury has been associated with multiple illnesses among occupants.

Exposure to other chemicals has been studied in the industrial setting but little is know regarding chronic effects of childhood exposures to such chemicals. In general, it is reasonable to assume that children arc more susceptible to injury from chemical exposure than adults. This is supported by epidemiologic data developed following accidental contamination of food supplies with organic compounds (polychlorinated biphenyls) or environmental contamination with low levels of heavy metals (mercury, lead, cadmium).

While it is beyond the training of a physician to try to interpret whether allowing children to live in a drug laboratory situation constitutes legal “endangerment”; it is certainly unlikely that a county health department or the Occupational Health and Safety Administration would allow an employer to expose members of the public or employees to such conditions. In addition, it is my opinion that the potential fire hazard of living around combustible solvents used in an illicit drug laboratory is enough of a safety concern that children should be excluded from living under such conditions. Finally, I feel that the conditions of a typical clandestine drug laboratory are such that uncontrolled exposure to chemicals, solvents and drug intermediates could lead to great bodily harm or death to children living in such an environment.

Evaluation of Children Living Near Clandestine Drug laboratories

The first priority in recommendations must be taking care of the most urgent problems first. For example, it there has been an explosion or exposure to products of combustion, these children should be referred immediately to an emergency room for evaluation. If the exposure is more chronic in nature then the exposure evaluation could proceed as outlined below.

It is necessary to take a careful and complete medical history when assessing the potential for injury from acute or chronic exposure to a clandestine drug laboratory or drug manufacturing/processing location. It is of importance to communicate directly with the agents/field representatives responsible for assessing the drug laboratory. For example, the clinician or consultant should inquire regarding the type of proeess(es) being performed.

Establish what chemicals were likely to be contaminating the environment. In addition, inquiry should be directed to the proximity of the manufacturing facility to the living and food preparation areas. Was there evidence that the children were involved in assisting in the preparation of drugs or handling of chemicals used in the process? If they were directly involved, were any protective clothing or respirators worn?

It would also be helpful to estimate the duration of exposure (minutes, days, weeks, etc.) and if they recalled any symptoms (respiratory, skin conditions, headaches, etc.). The nutritional status of the children should be assessed (age norms for height and weight, developmental milestones, etc.). Child protective services and others should assess the likelihood of physical and/or sexual abuse.

Laboratory assessment may be of some help to determine if there has been acute or chronic effects from drug laboratory exposures. While it is not possible or desirable to assay for every know drug or intermediate, it is reasonable to consider baseline evaluation for organ system toxicity. For example, if the manufacturing process involved exposure to a typical ephedrine reduction process, then it is likely there was exposure to ephedrine, methamphetamine, hydriotic acid, solvents as well as other chemicals. The evaluating clinician should probably consider obtaining the following in most cases:

1. Chemistry panel (including electrolytes, liver function, and kidney function)
2. Complete blood count
3. Urinalysis
4. Urine for drugs of abuse and intermediates (remember chain of custody details/documentation and should request State DOJ Lab analysis U’ possible)
5. In my opinion, it is unlikely that ”shotgun” ordering of other expensive and exotic

laboratory toxicology tests will be helpful in assessing these children when the basic toxicology screen and screening laboratory results are normal

Special Situations:

If the child complains of chest pain or shortness of breath then it might be reasonable to recommend a chest x-ray, pulse oximetry and spirometry. If rapid heart rate is noted the evaluating physician should consider a chest x-cay and electrocardiogram (FCG) in addition to toxicology screening. If there has been fire, individuals from these environments should be evaluated immediately in an emergency room and in most cases if initial screening and labs are normal should be under medical supervision for at least 6- 8 hours because of concern about delayed pulmonary effects from potential inhaled toxins.

Other testing should be considered in consultation with a medical toxicologist or poison center specialist. For example, if the process involved mercury or other heavy metals then consider heavy metal testing.

Finally, I believe we are very fortunate in Northern California to have a Regional Poison Control Center staffed with physicians and pharmacists trained in medical toxicology. If specific questions arise I recommend that you contact myself or the professionals on call for the center. I am hopeful that the UC Davis Medical Center staff will be willing to work closely with the Department of Justice and local agencies to provide services in the future that will help in the evaluation and treatment of children from these environments.

Reprinted with permission from author.