CASE REPORT

Presumed Mass Illness following a Pyridine Fumes Incident: Environmental Contamination versus Mass Hysteria

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Abbreviations:
ECG = electrocardiogram
IV = intravenous

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Abstract

This case study is based on a chemical spill in a warehouse in Belgium. Two victims were hospitalized, and a confluence of symptoms among the warehouse personnel had to be managed medically. An on-scene medical station and medical management team were deployed. A total of 51 victims were examined. Medical, political, and labor management arguments occurred. Medical findings and results from a thorough investigation helped prevent a presumed illness epidemic. The primary goals of the medical management of victims must include ensuring the health and safety of the personnel involved.

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Introduction

Mass sociogenic illness, or *epidemic hysteria*, refers to the spread of illness signs and symptoms within a cohesive group.[1] It occurs in the context of a credible threat that provokes great anxiety, such as a noxious odor. In this case, it resulted from pyridine fumes.[2–4] In this study, the hysteria occurred in a mostly male working environment and within the setting of an actual toxic spill.

The Hazard

Pyridine is a clear liquid with an odor that is sour, putrid, and fish-like. Pyridine is a simple heterocyclic aromatic organic compound that is structurally related to benzene, with one CH group in the six-membered ring replaced by a nitrogen atom. Pyridine is obtained from crude coal tar or is synthesized from acetaldehyde and ammonia.

Pyridine has an equatorial lone pair of electrons at the nitrogen atom that does not participate in the aromatic pi-system. This makes pyridine a basic compound with chemical properties similar to tertiary amines. Pyridine is protonated by reaction with acids and forms a positively charged aromatic polyatomic ion called pyridinium cation.

Pyridine is widely used as a solvent and reagent in organic chemistry and it is also a starting material in the synthesis of compounds used as an intermediate in making insecticides, herbicides, pharmaceuticals, food flavorings, dyes, rubber chemicals, adhesives, paints, explosives and disinfectants. Pyridine is also used as a denaturant for antifreeze mixtures, ethyl alcohol, and fungicides, and as a dyeing aid for textiles (Figure 1).[5]

Event

Everyone is exposed to very low levels of pyridine in air, water, and food. Workers may be exposed by breathing or touching it in industries that make pyridine or use it to make other products. People may breathe pyridine when it is released into the air from burning cigarettes and from hot coffee. People who live near hazardous waste sites or landfills where pyridine exists may be exposed to it by breathing contaminated air or by drinking contaminated water.

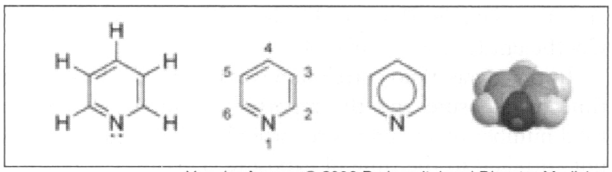

Figure 1—Pyridine chemical structure[5]

Damage—Health Effects

Although pyridine has been reported to reduce male fertility and is considered carcinogenic, no studies are available on people or animals experiencing the carcinogenic, fertility, or birth defects effects from the compound. Common symptoms of exposure to pyridine include: (1) headache; (2) coughing; (3) asthmatic breathing; (4) rapid breathing; (5) laryngitis; (6) giddiness; (7) sleepiness; (8) quickening pulse; (9) nausea; and (9) vomiting.[6]

Liver damage from exposure to pyridine has been found in animal studies and in some case reports involving humans. Mild skin and eye irritation also were seen.

Case Report

11 May 2005; 01:00 hours

A warehouse of an international express and logistics firm between Brussels and Aalst, Belgium, was the scene of the incident. During the night shift, a parcel containing 2.5 liters of pyridine was damaged. This caused the pyridine to spill, which produced a noxious odor. All 24 people working that shift continued working. Two people reported experiencing nausea and vomiting, but they continued working without taking any measures to receive help.

06:30 hours—Shift Change

The entire "Night Team" left the scene. The "Day Team" found the odor annoying and searched the warehouse for the origin of the odor. The damaged parcel was found quickly, and two employees started clearing the "contaminated area" without knowing which contaminant was involved. The manipulation of the damaged parcel provoked a new toxic cloud. The two men were intoxicated—they lost consciousness and experienced nausea and vomiting.

07:15 hours

The Fire Department was alerted. The alert did not mention any victims; it only stated that there was a chemical spill in the warehouse. The first fire engine crew that arrived at the scene immediately requested an ambulance crew to provide medical care of the injured. The warehouse was evacuated. The damaged parcel was placed in a closed container outside of the warehouse and the warehouse was ventilated by the Fire Department.

08:20 hours

The ambulance personnel stabilized the two exposed men and evacuated them to the hospital. Meanwhile, the Fire Chief arrived and began his investigation. The fire engine left the scene of the spill.

08:30 hours

The parcel and its contents were identified. The Fire Chief queried dispatch and quickly received the toxicity Fact Sheet, ToxFaQs™. Hereon, a cascade of events began. First, the Lieutenant Medical Doctor was informed. He informed the University Hospital Vrije Universiteit Brussel Emergency Department that two pyridine-contaminated victims soon would be arriving in the Emergency Department, and that it was possible that a mass-contamination had occurred. In the Emergency Department, decontamination equipment and personnel were prompted to go to the ambulance arrival area.

The Fire Chief ordered the first engine personnel to go to the Emergency Department to be decontaminated and receive a full medical examination.

08:50 hours

A Medical Team and a Medical Management Team from the Emergency Department were dispatched to the scene of the spill. These facts were gathered:

1. No concentration measurements were performed. A vital evaluation element for assessing the dose-response was missing, and hence the Medical Team could not review the concentration and time of exposure. The only data that was available included the time of exposure;
2. Only two people had skin contact with the pyridine. They both were treated for the exposure in the ED;
3. A total of 24 people (night shift) had experienced prolonged inhalation of the pyridine fumes; only two of them exhibited signs of illness. All of those who potentially were exposed had to be contacted and were assembled to leave for a medical examination. Five nightshift employees were interim employees, and had to be contacted through the interim agency that had arranged their employment; and
4. A total of 10 people who work the day shift had experienced minor exposure to pyridine fumes. Multiple truck drivers who had visited the warehouse during the morning also were exposed; all of them had to be examined.

09:30 hours

The warehouse manager and his team had recalled all of the "exposed" personnel. The Medical Team opened an on-scene medical station and examined all of the personnel who had experienced physical signs of illness. Meanwhile, union members arrived and contacted the potentially exposed personnel. One message was communicated clearly by the union members; it was not the nightshift's fault; it is the lack of security measures taken by the management that caused this accident, and it was the workers' health that was at stake.

The local police and the Inspector of the Environmental Agency arrived at the site. They began the investigation and quickly were confronted by the union members and their view of the case.

Finally, the Mayor and the press arrived on-scene. After the press mentioned the union intervention and the

"potential risk of cancer", the number of "ill personnel" grew quickly. A total of 51 people reported to the medical station.

10:30 hours—End of Interventions

The warehouse was cleared and ventilated. The Internal Prevention Officer and the Occupational Medical Service assumed the responsibility to manage the medical follow-up of the potentially exposed personnel.

12:00 hours and Later

Emergency Department personnel continued to register patients who presented with signs of pyridine illness. A total of seven persons presented to the ED that day. The last "victim" arrived the next day at 14:00 hours (31 hours after the potential exposure).

Medical Findings

The initial two victims were hospitalized. A 44-year-old male had the following signs and symptoms: (1) normal vital signs; (2) headache; (3) nausea; (4) epigastric pain; (5) chest pain; (6) shortness of breath; and (7) shivering. The shivering probably was due to the decontamination procedure and the low ambient temperature in the decontaminating area. Initially, bronchospastic wheezing was auscultated and was treated with a beta-2-mimetic aerosol. Analysis of blood samples, a chest x-ray, and an electrocardiogram (ECG) showed no abnormalities.

A 45-year-old male had the following symptoms and signs: (1) normal vital signs; (2) low back pain; (3) chest pain; (4) nausea; (5) pyrosis; (6) stomachache; and (7) shivering. No abnormalities were identified by a chest x-ray and an ECG. Blood samples manifested an elevated lactate level (4 mmol/l).

Both patients were admitted onto the Observation Ward of the ED. Both underwent the same treatment with intravenous (IV) fluids and IV stomach protection. After 24 hours, the two men were free of symptoms and signs. The blood lactate-level and the kidney and liver functions were normal. The men were discharged from the hospital.

At the scene of the event, 51 people were examined. Forty-three victims had been exposed to pyridine from inhalation. One person claimed to have touched the pyridine spill with his finger and tasted it. Eight people were not exposed and did not have any symptoms, but wanted a check-up.

The time of exposure ranged 5–330 minutes (average = 46 ±67 minutes (standard deviation). A total of 11 symptoms were reported: (1) extreme salivation; (2) bad taste; (3) sore throat; (4) rhinitis; (5) dizziness; (6) headache; (7) coughing; (8) nausea; (9) vomiting; (10) skin irritation; and (11) eye irritation.

A total of 17 people were examined at the ED, 16 in the AZVUB hospital, and one in Geraardsbergen hospital. They mainly complained of nausea, headache, dizziness, and stomachache. None of them were admitted to the hospital.

Discussion

The on-scene examination revealed no clinically significant findings. Due to the lack of concentration measurements, the only dose-related data that could be used in the analysis was the time-of-exposure. Given the time-of-exposure and the data, a Pearson Product Moment Correlation Coefficient (r) was calculated.

In this dataset, no correlation was observed between the time of exposure and the reported symptoms. Even the total number of symptoms reported by those "exposed" did not correlate to the time of exposure (Pearson Correlation = 0.46). Only vomiting appeared to be more likely according to the length of exposure (Pearson Correlation = 0.88).

The arrival of the union seemingly exacerbated the symptoms and complaints reported. For example, people eager to be examined due to complaints were symptom-free during examination.

Feedback from the in-hospital medical findings regarding the hospitalized men also stated the lack of evidence of correlation between the toxic exposure and the symptoms evoked.

Mass Hysteria and Clinical Management

The confluence of eight symptoms or conditions typically indicates mass sociogenic illness[1] and permits a presumptive diagnosis while investigations are underway. These include symptoms with: (1) no plausible organic basis; (2) rapid onset and recovery; (3) occurrence in a segregated group; (4) the presence of extraordinary anxiety; (5) the ability to spread via sight, sound, or oral communication; (6) a spread that moves down the age scale, beginning with older or higher-status people; and (7) a preponderance of female participants. In this case, a mainly male working force presented with symptoms. During workplace epidemics, the background mechanisms are thought to be generalized beliefs and triggering events. This new belief spreads through sociometric channels. Predisposing factors include boredom, pressure to produce, physical stressors, poor labor-management relations, impaired interpersonal communications, and lack of social support.[4] This investigation and its results did not provide adequate evidence that these cases described a purely sociogenic illness, but several inclusion criteria were seen.

Conclusion

Through experience or training, most emergency personnel are aware of individual cases of hysteria. They are less educated and less knowledgeable about epidemic hysteria.

The settings were:

1. the presence of real victims;
2. a credible threat: a toxic spill with noxious odors;
3. lack of intervention or emergency planning by the warehouse management; and
4. a work setting characterized by:
    a. pressure to produce;
    b. boredom; and
    c. poor or impaired labor-management relations (union versus management).

In such an event, a thorough investigation must be completed. The diagnosis of mass hysteria should not be an excuse for incomplete medical or environmental investigations. This investigation is for diagnoses, identification, treatment, and reassurance of the employees, management, and press that additional physical effects are unlikely to occur. Nevertheless, significant healthcare resources were

consumed to ensure the safety of warehouse personnel. The use of these resources could have been avoided by better planning and labor-management communication. The resources could have been invested in better training of emergency personnel regarding this type of problem.

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