

OUTBREAK INVESTIGATION INTRODUCTORY INFORMATION

Note to Participants:

Included in the Outbreak Investigation Introductory Information is the diagnosis of the individuals involved in the Outbreak Investigation. It is important to recognize that your goal is to determine the cause or etiology of the disease, not whether the diagnosis was correct – to be clear, the diagnosis is correct, but be careful not to lose focus of the goal of this activity, as time is very short.

BACKGROUND OF INCIDENT

At 2:45pm, on a chilly autumn day, a school nurse contacted the American Association of Poison Control Centers hotline regarding the onset of illnesses in 73 children at a single high school, ages 14-18. All of the students had visited the school nurse within 2 hours of their scheduled lunch break complaining of blueness of the lips and fingers. After a bit of investigative research, the poison control center and their team was able to rule out the likelihood that the event was the result of a local stain and the team ruled that the students should be taken to a nearby hospital to be examined by physicians.

When the students were examined, additional complaints including nausea, vomiting, and headache were discovered. A physician in the emergency department diagnosed the children with methemoglobinemia (MetHb) on the basis of cyanosis (blue coloration of the skin and mucous membranes) with normal pulse oximetry readings of oxygen saturation (greater than 88%). Initial questioning by the American Association of Poison Control Centers did not identify any possible sources. Treatment consisted of supplemental oxygen and intravenous methylene blue. All children are expected to recover fully within the next 24 to 48 hours.

Case Individuals:

- | | |
|----------------------------------|----------------|
| 1. Physician: | Dr. Askew |
| 2. School Custodian: | Chad DeJong |
| 3. Principal: | Francis Gordon |
| 4. Teacher (10th Grade English): | Perri Farr |
| 5. Cafeteria Manager: | Jeremy DeFoe |
| 6. Cafeteria Staff Member: | Naomi Thompson |
| 7. Hospitalized Student 1: | Ginger Rogers |
| 8. Non-Hospitalized Student 2: | John Wayne |
| 9. Non-Hospitalized Student 3: | Adrian Monk |
| 10. Hospitalized Student 4: | Makayla Quinn |
| 11. Laboratory Technician: | Lucas Klumper |

Interviewer/Investigator:

DEFINING METHEMOGLOBINEMIA

Methemoglobinemia is a blood disorder in which an abnormal amount of hemoglobin builds up in the blood. Hemoglobin is the oxygen-carrying molecule found in red blood cells. In some cases of methemoglobinemia, the hemoglobin is unable to carry oxygen effectively to body tissues, resulting in blue coloring of the skin and mucous membranes.

TYPES OF METHEMOGLOBINEMIA

1. **Inherited Methemoglobinemia (Type 1):** The first form of inherited methemoglobinemia is passed on by both parents. The parents usually do not have the condition themselves, but they carry the gene that causes the condition. It occurs when there is a problem with an enzyme called cytochrome b5 reductase. Symptoms include bluish coloring of the skin.
2. **Inherited Methemoglobinemia (Type 2):** The second form of inherited methemoglobinemia, called hemoglobin M disease, is caused by defects in the hemoglobin molecule itself. Only one parent needs to pass on the abnormal gene in order for the child to inherit the disease. Symptoms include bluish coloring of the skin.
3. **Acquired Methemoglobinemia:** Acquired methemoglobinemia is more common than the inherited forms of the disease. In this situation, methemoglobinemia results from exposure to certain drugs, chemicals, or foods. Symptoms include bluish coloring of the skin, headache, fatigue, shortness of breath, and lack of energy.

AGENTS CAUSING ACQUIRED METHEMOGLOBINEMIA

Drug and chemical agents that may cause acquired methemoglobinemia include:

1. Anesthetics such as benzocaine and Xylocaine;
2. Benzene;
3. Certain antibiotics;
4. Nitrites: Nitrite and nitrate ions are naturally occurring forms of nitrogen that can be present in ground and surface water and can be used as a food preservative because they inhibit the growth of *Clostridium botulinum*. Acquired methemoglobinemia can occur in infants who are very ill and have been exposed to low levels of nitrates or nitrites or infants who are fed too many vegetables containing nitrates (such as beets). The table on the following page identifies various sources of nitrite and nitrate ions.

| Report Inducers of Methemoglobinemia | |
|--------------------------------------|---|
| Agent | Source |
| Inorganic nitrates/nitrites | Contaminated well water Meat preservatives Vegetables - carrot juice, spinach Silver nitrate burn therapy Industrial salts Contaminants from nitrous oxide canisters used for anesthesia |
| Organic nitrites | |
| Butyl/isobutyl nitrite | Room deodorizer propellants |
| Amyl nitrite | Inhalant in cyanide antidote kit |
| Nitroglycerine | Oral, sublingual, or transdermal pharmaceuticals for treatment of angina |
| Others | |
| Amiline/aminophenols | Laundry ink |
| Nitrobenzene | Industrial solvents, gun-cleaning products |
| Local anesthetics | Benzocaine, lidocaine, propitocaine, prilocaine |
| Sulfonamides | Antibacterial drugs |
| Phenazopyridine | Pyridium |
| Antimalarials | Chloroquine, primaquine |
| Sulfones | Dapsone |
| p-Aminosalicylic acid | Bactericide (tuberculostatic) |
| Naphthalene | Mothballs |
| Copper sulfate | Fungicide for plants, seed treatment |
| Resorcinol | antiseborrheic, antipruritic, antiseptic |
| Chlorates | Matches, explosives, pyrotechnics |
| Combustion products | Fires |

Adapted from Dabney BJ, Zelarny PT, Hall AH. Evaluation and treatment of patients exposed to systemic asphyxiants. Emerg Care Q. 1990;6:65-80.