Food Safety and Methemoglobinemia (Blue Baby Syndrome)

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06/04/2019
What is a Foodborne Disease Outbreak?

- A foodborne disease outbreak is defined as an incident in which two or more persons experience a similar illness resulting from the ingestion of a common food.* Foodborne disease outbreaks should be reported to CDC’s Enteric Diseases Epidemiology Branch through the National Outbreak Reporting System (NORS)

* Before 1992, three exceptions existed to this definition; only one case of botulism, marine-toxin intoxication, or chemical intoxication was required to constitute a foodborne disease outbreak if the etiology was confirmed. The definition was changed in 1992 to require two or more cases to constitute an outbreak.

https://www.cdc.gov/foodsafety/outbreaks/investigating-outbreaks/confirming_diagnosis.html
The Situation

• A local ED called the Iowa Poison Center regarding two young children who had been brought in because of “grey-colored skin”
• No recent illness, no ill contacts
• HR 150’S, RR 36-40, BP 89/70
• Initial Labs notable for metabolic acidosis
The Situation

• Both children were found to have significantly elevated MetHemoglobin concentrations and were also anemic

• Treatment
  – Intubation, ventilation, oxygenation
  – Methylene blue, 1 mg/kg (specific antidote)
  – Transfusion 1 unit PRBCs
  – Discharged home on Hospital Day 5
The Case

- Child A
  - Methemoglobin = 63%
  - Hb 7.2 g/dL
  - Extubated Hospital Day 3
- Child B
  - Methemoglobin = 48.9%
  - Hb 7.4 g/dL
  - Extubated Hospital Day 2

Photo Courtesy: "†Kimberly A. Barker, PharmD, DABAT"
The Case

- No pharmaceutical exposures
- No known chemical exposures
- No known history of G-6-P Dha deficiency
- Diet: Goat’s milk, well water, molasses

- Call made to County PH Department
Methemoglobinemia

- Iron in hemoglobin oxidized from 2+ to 3+
  * Oxidation can lead to hemolysis
- Blood classically has chocolate brown color
- Patients cyanotic but not necessarily distressed
- Large list of drugs and toxins causing MetHb

MetHb Signs and Symptoms

• Signs and Sx are that of oxygen deprivation
  – 3-15% Gray skin discoloration, SpO2 of ~85%
  – 15-20% Cyanosis, chocolate brown blood
  – 20-50% SOB, HA, fatigue, dizzy, LOC, syncope
  – 50-70% Increased RR, metabolic acidosis, arrhythmias, seizures, coma
  – >70% Death (usually, but not always)
Causes of Methemoglobinemia

- Pharmaceuticals
  - * Phenazopyridine, local anesthetics, dapsone, nitrites, nitrates, chloroquine, etc.
- Chemicals / Toxins*
  - Nitrite and Nitrate derivatives, perchlorates, chlorites, copper sulfate, naphthalene, etc.
- Hemoglobin M Disease
- NADH Cytochrome b5 Reductase Deficiency
  - Methemoglobin reductase deficiency
MetHb Treatment: Methylene Blue

• Dose: 1-5 mg / kg
  * Slow IVP over 5 minutes
• Becomes oxidative at 5 mg / kg
• Results in blue urine
Nitrate Detection in Foods- FERN method

• Ion Chromatography
• Samples are diluted in water, then tested
• Peaks areas are compared to known amounts of nitrate
Food Chemistry at SHL

- **FERN- Food Emergency Response Network**
  - Funded through FDA
  - One of 14 state labs throughout the US that provide surge capacity
  - Perform testing for a wide variety of potential contaminants in food

- **ISO Accreditation**
Sample Results

- Blue = Sample (diluted 1:10)
- Black = 1000 ppm (1 mg/mL) standard

- Final concentration of nitrate in the sorghum syrup ~ 19 mg/mL nitrate per gram of syrup
- Emergency situation Validation—FDA guidance
Partnership with local counties

**Drinking Water Collection Instructions**

**IOWA WELL SURVEY: BACTERIA AND NITRATE**

**COLLECT SECOND**

**BEFORE SAMPLE COLLECTION**
- Freeze any provided ice packs before collecting the water sample. Not all lots will contain ice packs.
- Prepare to ship the sample to ensure its arrival at the laboratory within 48 hours of collection.
- Seal the sample in a 1-L plastic bottle.
- Samples that do not meet temperature or time requirements may not be analyzed, requiring the submitter to resample. If the sample is analyzed, results may be invalid unless the submitter or regulator instruct otherwise.

**SAMPLE COLLECTION**
1. Choose a faucet:
   - Choose an indoor faucet. Do not collect samples from outdoor hydrants, dirty or leaking faucets, or faucets with sediments or sprayer heads.
2. Remove the aerator screen:
   - Not all faucets have aerators. If there is an aerator screen, remove it. If it does not come off, choose a different faucet.
3. Flush the cold water line:
   - Turn the cold water to a moderate flow so it does not splash. Let the water run for 2–3 minutes to flush out the line.
4. Reduce the water stream:
   - Reduce the water flow to a slow, gentle stream so it does not splash out of the bottle.
5. Fill each bottle:
   - Slowly fill the bottle to the 120-ml line or the shoulder, whichever is indicated on the bottle.
6. Label each bottle:
   - Label each bottle with the date, time, and location of collection.
7. Chill the bottles:
   - Immediately begin cooling the samples. Do not freeze.

**A study of private well water in Iowa**
State Hygienic Laboratory

Milford

Ankeny

Coralville
State Hygienic Laboratory
Public Advisory
State Hygienic Laboratory
Acknowledgement

Dr. Edward Bottei
Dr. Caitlin Pedati
Steve Mandernach
Tim Wickam
James Lacina