


A Poison Most Peculiar:
Suicide by Sodium Azide


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Disclosures

- None



Background

- 28 y/o male with history of suicidal ideation and attempts
- Sent text messages to wife one night stating, in part, "I just want to say goodbye," and "I'm sorry I was a bad husband."
- He then called his wife and said the same thing



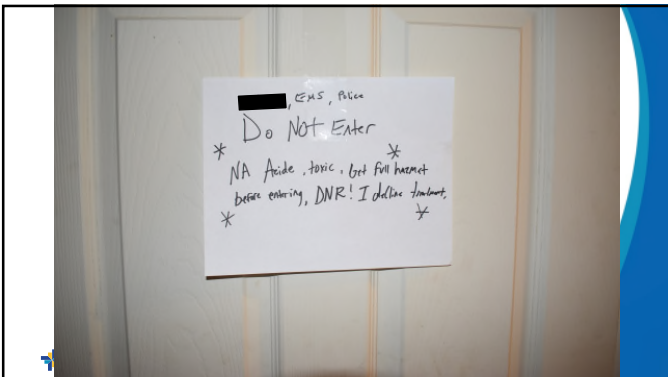
Background

- His breathing escalated to panting really hard, and then his wife couldn't hear anything else from him
- She called a friend to check on him
- When the friend was unable to gain entry into the home, police were called who forced entry



Scene











Scene

- When police officers entered the room, there was a haze, fog, &/or misty type cloud in the room
- Five officers exhibited symptoms of exposure:
 - Headache that got worse and worse, chest pain, extremely scratchy throat
 - Headache and throat discomfort
 - Headache and sore throat
 - Headache and feeling that throat was tightening up
 - Lightheaded after turning over decedent
- Four of the officers evaluated at the hospital and then released



Autopsy



External Examination

- Cyanosis of:
 - Nose
 - Gingivae
 - Fingertips
- Evidence of injury:
 - 1-5/8 x 3/8 inch red, dried abrasion over left eyebrow
 - ¼ inch linear red abrasion on lower right leg



Internal Examination

- Petechiae on posterior one-third of the tongue, larynx, and trachea
- Laryngeal and esophageal cyanosis
- Approx. 250 mL of partially digested food and clear liquid in the stomach
- Congested gastric mucosa, lungs, and liver



FBI Laboratory Testing

Specimen	Result	Note(s)
Item 1 blood	Azide was not detected.	1, 2
Item 2 blood	Azide was not detected.	1, 2
Item 3 gastric contents	Azide was identified.	1
Item 4 lung tissue	Azide was identified.	1, 3

Notes:

- 1 Analysis was performed by acidification followed by headspace gas chromatography with mass spectrometry (HS-GC-MS).
- 2 The non-detection of azide in Item 1 and Item 2 was confirmed by demonstrating detection of azide in portions of those specimens which had been spiked with azide at a concentration of 5 micrograms per milliliter (µg/ml).
- 3 For Item 4, analysis was performed on the fluid surrounding the solid tissue.



FBI Laboratory Testing

The identification of azide in Item 3 and Item 4 indicates exposure to an azide-containing compound, such as sodium azide, lead azide, or tetrabutylammonium azide. Current FBI Laboratory procedures cannot determine the specific compound that was the source of this exposure.

Remarks:

CAUTION: The estimated concentration of azide in Item 3 is high enough that the entire specimen should be treated as an acutely toxic material.

Azide is a highly toxic chemical ion found as part of a number of different synthetic compounds with various uses. Sodium azide is the most commonly encountered of these compounds.



Autopsy Report

- Cause of death: Toxic effects of sodium azide
- Manner of death: Suicide



Sodium Azide

- White to colorless
- Crystalline powder
- Highly water soluble
- Tasteless
- Odorless
- Forms hydrazoic acid (HN_3) when combined with water



Uses

- Component in many car airbag systems
- Chemical preservative in laboratories and hospitals
- Reagent in synthetic laboratory work
- Component in the manufacture of rubber, latex, and lead acid
- Soil sterilizing agent, fungicide, herbicide, or pesticide
- Used to treat hypertension in the 1950s



Possible Mechanisms of Action

- Human health effects of sodium azide were first reported in 1927, but to date, the mechanism of toxicity remains unknown
- Some possible mechanisms of action:
 - Inhibition of cytochrome oxidase and interference with cellular respiration
 - Enhanced excitatory transmission in the CNS after conversion to nitric oxide
 - Stimulation of carotid body chemoreceptors



Signs and Symptoms of Exposure (Low-Dose)

- | | |
|---------------|-------------|
| • Hypotension | • Diarrhea |
| • Dizziness | • Faintness |
| • Headache | • Syncope |
| • Nausea | • Wheezing |
| • Vomiting | • Coughing |



Signs and Symptoms of Exposure (High-Dose)

- | | |
|----------------------|-----------------------|
| • Hypotension | • Tachycardia |
| • Metabolic acidosis | • Bradycardia |
| • Coma | • Systole |
| • Seizures | • Tachypnea |
| • Cardiac arrhythmia | • Pulmonary edema |
| • Oliguria | • Respiratory failure |



Specimen Considerations

- Sodium azide is extremely labile
- Acidity and enzyme activities can induce rapid deterioration postmortem
- Blood and urinary samples likely insufficient to confirm presence
- Need multiple samples of biological fluids and tissues
- In most reported cases, major concentrations observed in the stomach, bile, brain, liver, kidney, lung, and muscle
- Analysis must be performed as soon as possible



Specimen Recommendations

- Get to autopsy quickly
- Freezing is best
- Specimens must be fresh (not embalmed or formalin-fixed)
- Best specimens:
 - Lung
 - Gastric contents



Specimen Recommendations

- Lung:
 - Put chunk of wet tissue in 50 cc cryo-compatible plastic centrifuge tube
 - Don't add any solution
 - Freeze



Specimen Recommendations

- Gastric contents:
 - Considered hazardous material (shipping consideration)
 - Option 1: put in sterile specimen cup
 - Option 2 (ideal):
 - Don't submit entire specimen cup
 - Put in 15 cc cryo-compatible plastic centrifuge tube
→ 5 mL is more than enough
 - Freeze



Specimen Recommendations

- Bile has given positive results
 - 15 cc in plastic centrifuge tube (cryo-compatible)
 - Freeze
- Only blood? Don't bother
 - Something causing chemical to break down
 - Residual enzyme in blood (esterase)?
 - Reaction with preservative agent?



Autopsy Safety

- Potential for liberation of hydrazoic acid from the stomach
- Unless absolutely necessary, avoid opening the stomach
- If unavoidable, perform autopsy in well-ventilated setting, & ideally:
 - Wearing a supplied air respirator (or)
 - Under a fume hood (or)
 - With air extractor over autopsy table
 - Nitrile gloves Ok



Autopsy Safety

- Avoid pouring gastric contents down drain
- Hydrazoic acid can react with copper and lead metal drain pipes to form explosive azide salt
- Less risk with PVC pipes
- If contents go down the drain, flush sink very thoroughly with water



Specimen Handling

- Avoid metal containers
- Have a blood specimen tested for infectious diseases at the time of autopsy
 - If negative, can use hazardous waste disposal
- Otherwise, have to work with biohazardous waste vendor for disposal
 - Challenging because a combo (potentially) of infectious material and hazardous waste




Scene Considerations

- Sodium azide (NaN_3) forms hydrazoic acid (HN_3) when combined with water (as in our case)
- Can enter the body via cutaneous absorption or inhalation of hydrazoic acid vapor
- No specific antidote exists
- No treatment has demonstrated any efficacy
- Sodium azide poisoning is treated with supportive medical care in a hospital setting
- The most important thing is for victims to seek medical treatment as soon as possible




Case Revisited



Sodium Azide

- Toxic dose: 10 mg/kg or above 700 mg
- Decedent consumed approximately 75 g
- He researched method on the internet
- He purchased sodium azide through Amazon



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