Intravenous acetaminophen overdose in an infant

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Truman Medical Center
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Introduction
- Intravenous (IV) acetaminophen (APAP) use has increased significantly over the past decade
- There are limited cases of IV APAP overdose reported in the literature
- No consensus exists on evaluation/management of IV APAP overdoses
- We present a case report of IV APAP overdose on an infant that resulted in a benign outcome following IV N-acetylcysteine (NAC) treatment

Case Report
- A 3 mo old (6kg) otherwise healthy infant underwent general anesthesia for removal of a vallecular cyst
- The child inadvertently received 500mg (83 mg/kg) IV APAP intraoperatively and the error was identified at the end of the case
- Post operatively the child had normal vital signs and a normal physical exam
- IV NAC (150mg/kg bolus then 15mg/kg/hr) was started at 4 hours post-APAP infusion
- The child remained well without vomiting
- Labs remained normal at 20 hours post APAP at which time NAC was discontinued and the child was discharged home.

<table>
<thead>
<tr>
<th></th>
<th>4 hours post APAP</th>
<th>20 hours post APAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Total bilirubin</td>
<td>0.5 mg/dl</td>
<td>0.8 mg/dl</td>
</tr>
<tr>
<td>AST</td>
<td>50 U/L</td>
<td>29 U/L</td>
</tr>
<tr>
<td>ALT</td>
<td>22 U/L</td>
<td>22 U/L</td>
</tr>
<tr>
<td>[APAP]</td>
<td>52 mcg/ml</td>
<td>&lt;10 mcg/ml</td>
</tr>
</tbody>
</table>

Discussion
- IV APAP overdoses reported in the literature range from 75mg/kg to 307 mg/kg and often result from 10 fold dosing errors.
- Time to NAC initiation in cases is <4 hours to >24 hours
- 75 mg/kg is the smallest IV dose associated with hepatotoxicity
- 614 mg/kg (307 mg/kg x 2 6 hour dosing interval) is the largest dose not associated with hepatotoxicity
- No hepatotoxicity occurred in those administered NAC within 4 hours
- Toxicokinetiics are different between oral and IV overdoses making assessment and treatment decisions complicated (i.e. inability to use APAP nomogram)
- Toxicologists should be aware of challenges in managing IV APAP overdoses and consider liberal, early use of NAC

Conclusion
- We report a case of IV APAP overdose in an infant with a benign outcome following early initiation of NAC
Chloroquine and hydroxychloroquine exposures reported to poison centers before the COVID-19 pandemic

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¹South Texas Poison Center, San Antonio, TX, USA; ²North Texas Poison Center, Dallas, TX, USA; ³Independent Researcher, Austin, TX, USA

Background

• Structurally similar to quinine, both chloroquine (CQ) and hydroxychloroquine (HCQ) are well-known antimalarials with anti-inflammatory properties.

• Notably, these drugs have a narrow therapeutic range that may yield severe complications such as cardiomyopathy, neuromyopathy, and retinopathy.

• Due to potential antiviral activity against SARS-CoV-2, CQ/HCQ are being studied for prophylaxis or treatment.

• This study intended to characterize CQ and HCQ exposures reported to poison centers prior to the COVID-19 pandemic.

Methods

• Cases were CQ and HCQ exposures reported to a statewide poison center network during 2000-2019.

• Case distribution was determined for patient demographics, exposure circumstances, and cases involving only CQ and HCQ for management and outcome.

• This study intended to characterize CQ and HCQ exposures reported to poison centers prior to the COVID-19 pandemic.

Results

• 758 CQ and HCQ exposures were identified: 73 (9.6%) CQ and 685 (90.4%) HCQ.

• 99.3% of the exposures occurred by ingestion.

Demographics

<table>
<thead>
<tr>
<th></th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>514</td>
<td>67.8%</td>
</tr>
<tr>
<td>Age &gt; 20 years</td>
<td>429</td>
<td>56.6%</td>
</tr>
</tbody>
</table>

Most common exposure reason

<table>
<thead>
<tr>
<th>Reason</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unintentional</td>
<td>228</td>
<td>(30.1%)</td>
</tr>
<tr>
<td>Therapeutic error</td>
<td>310</td>
<td>(40.9%)</td>
</tr>
<tr>
<td>Intentional</td>
<td>159</td>
<td>(21.0%)</td>
</tr>
<tr>
<td>Adverse reaction</td>
<td>23</td>
<td>(3.0%)</td>
</tr>
<tr>
<td>Other/unknown</td>
<td>7</td>
<td>(0.9%)</td>
</tr>
</tbody>
</table>

Medical Outcome

<table>
<thead>
<tr>
<th>Outcome</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>No effect</td>
<td>152</td>
<td>(35.9%)</td>
</tr>
<tr>
<td>Minor effect</td>
<td>29</td>
<td>(6.9%)</td>
</tr>
<tr>
<td>Moderate effect</td>
<td>32</td>
<td>(7.6%)</td>
</tr>
<tr>
<td>Major effect</td>
<td>8</td>
<td>(1.9%)</td>
</tr>
<tr>
<td>Not followed, nontoxic</td>
<td>28</td>
<td>(6.6%)</td>
</tr>
<tr>
<td>Not followed, minimal</td>
<td>147</td>
<td>(34.8%)</td>
</tr>
<tr>
<td>Not followed, toxic</td>
<td>24</td>
<td>(5.7%)</td>
</tr>
<tr>
<td>Unrelated</td>
<td>3</td>
<td>(0.7%)</td>
</tr>
</tbody>
</table>

Most common treatments

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Count</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Activated charcoal</td>
<td>177</td>
<td>(41.8%)</td>
</tr>
<tr>
<td>Dilute/irrigate/wash</td>
<td>91</td>
<td>(21.5%)</td>
</tr>
<tr>
<td>Food/snack</td>
<td>54</td>
<td>(12.8%)</td>
</tr>
<tr>
<td>IV fluids</td>
<td>50</td>
<td>(11.8%)</td>
</tr>
</tbody>
</table>

Conclusion

• Prior to investigational use for the COVID-19 pandemic, most CQ and HCQ exposures involved adults, female patients, unintentional exposures, and occurred by ingestion.

• More than half of isolated CQ and HCQ exposures were managed on-site and did not have serious outcomes.

• These data provide a baseline for chloroquine and hydroxychloroquine exposures prior to the SARS-CoV-2 pandemic.
Phosphide exposures foster caution

Maria Hinojosa, PharmD1, Shawn M. Varney, MD1, Mathias B. Forrester2

1South Texas Poison Center, UT Health San Antonio, TX; 2Independent Researcher, Austin, TX

Aluminum and zinc phosphides are used as grain fumigants and rodenticides. Following exposure to moisture or acid, phosphides release phosphine, a colorless, heavier-than-air, toxic gas with a garlic or rotten fish odor. Toxicity occurs after gas inhalation or solid ingestion. Rapid progression to multiorgan failure, cardiovascular collapse, and death may occur.

This study aimed to characterize phosphide exposures reported to a statewide poison center network.

**Background**

- Majority of phosphide exposures reported to the Texas Poison Center Network during 2000-2018 occurred by inhalation, were unintentional, and resulted in nonserious outcomes, although six deaths occurred.

**Methods**

- Cases were phosphide exposures reported to a statewide poison center network during 2000-2018.
- A phosphide exposure was defined as an exposure assigned the Toxicall® substance generic code 0201036 (aluminum phosphide) or 0201052 (zinc phosphide).

**Results**

- Total exposures 228
- Aluminum phosphide 142 (62.3%)
- Zinc phosphide 86 (37.7%)
- Unintentional exposure 204 (89.5%)
- Annual # exposures 3 – 31

**Most common clinical effects**

<table>
<thead>
<tr>
<th>Condition</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nausea</td>
<td>17.1</td>
</tr>
<tr>
<td>Vomiting</td>
<td>15.4</td>
</tr>
<tr>
<td>Headache</td>
<td>9.6</td>
</tr>
<tr>
<td>Dizziness, vertigo</td>
<td>7.5</td>
</tr>
<tr>
<td>Cough, choke</td>
<td>7.5</td>
</tr>
<tr>
<td>Dyspnea</td>
<td>7.5</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>6.2</td>
</tr>
</tbody>
</table>

**Exposures**

- Total exposures 228
- Aluminum phosphide 142 (62.3%)
- Zinc phosphide 86 (37.7%)
- Annual # exposures 3 – 31
- Unintentional exposure 204 (89.5%)

**Demographics**

- Male 147 (64.5%)
- Age >20 years 130 (57%)

**Route**

<table>
<thead>
<tr>
<th>Route</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Inhalation</td>
<td>141 (61.8%)</td>
</tr>
<tr>
<td>Ingestion</td>
<td>72 (31.6%)</td>
</tr>
<tr>
<td>Dermal</td>
<td>30 (13.2%)</td>
</tr>
<tr>
<td>Ocular</td>
<td>5 (2.2%)</td>
</tr>
<tr>
<td>Injection</td>
<td>2 (0.9%)</td>
</tr>
<tr>
<td>Unknown</td>
<td>4 (1.8%)</td>
</tr>
</tbody>
</table>

**Exposure Site**

<table>
<thead>
<tr>
<th>Site</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own residence</td>
<td>121 (53.1%)</td>
</tr>
<tr>
<td>Workplace</td>
<td>71 (31.1%)</td>
</tr>
<tr>
<td>Public area</td>
<td>17 (7.4%)</td>
</tr>
<tr>
<td>Other/unknown</td>
<td>19 (8.3%)</td>
</tr>
</tbody>
</table>

**Medical Outcome**

<table>
<thead>
<tr>
<th>Outcome</th>
<th>N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>No effect</td>
<td>53 (23.2%)</td>
</tr>
<tr>
<td>Minor effect</td>
<td>54 (23.7%)</td>
</tr>
<tr>
<td>Moderate effect</td>
<td>24 (10.5%)</td>
</tr>
<tr>
<td>Major effect</td>
<td>4 (1.8%)</td>
</tr>
<tr>
<td>Death</td>
<td>6 (2.6%)</td>
</tr>
<tr>
<td>Not followed, nontoxic</td>
<td>4 (1.8%)</td>
</tr>
<tr>
<td>Not followed, minimal</td>
<td>52 (22.8%)</td>
</tr>
<tr>
<td>Not followed, toxic</td>
<td>17 (7.5%)</td>
</tr>
<tr>
<td>Unrelated effect</td>
<td>14 (6.1%)</td>
</tr>
</tbody>
</table>

**Most Common Treatments**

- Dilute/irrigate/wash 75 (32.9%)
- Fresh air 57 (25.0%)
- Oxygen 55 (24.1%)
- IV fluids 40 (17.5%)

**Conclusion**

- Most reported aluminum and zinc phosphide exposures involved adults, males, were unintentional and occurred by inhalation.
- Majority of exposures were managed at a healthcare facility, and resulted in nonserious outcomes, although six deaths occurred.
Benzocaine exposures in young children - Numbingly uneventful

Maria Hinojosa, PharmD1, Shawn M. Varney, MD1, Mathias B. Forrester2

1South Texas Poison Center, UT Health San Antonio, TX; 2Independent Researcher, Austin, TX

Over-the-counter (OTC) topical oral anesthetics commonly contain benzocaine. Such products for teething pain carry a risk of causing methemoglobinemia in children. In May 2018, the U.S. Food and Drug Administration (FDA) warned that OTC benzocaine-containing products should not be used in children younger than two years. This study aimed to describe benzocaine exposures in children five years of age and younger reported to a poison center network.

### Background
- Over-the-counter (OTC) topical oral anesthetics commonly contain benzocaine.
- Such products for teething pain carry a risk of causing methemoglobinemia in children.
- In May 2018, the U.S. Food and Drug Administration (FDA) warned that OTC benzocaine-containing products should not be used in children younger than two years.
- This study aimed to describe benzocaine exposures in children five years of age and younger reported to a poison center network.

### Methods
- Cases were exposures to benzocaine-containing products involving patients aged 0-5 years reported to a statewide poison center network during 2000-2018.
- Case distribution was determined for factors related to patient demographics, exposure circumstances, management, and outcome.

### Results
- 5,255 pediatric benzocaine exposures were identified.
- The annual number declined from 432 in 2002 to 105 in 2018.

### Conclusion
- Pediatric benzocaine exposures reported to this poison center network have declined over the past two decades.
- Despite FDA warnings, exposures are anticipated due to the accessibility and availability of these products.

<table>
<thead>
<tr>
<th>Route</th>
<th>Ingestion</th>
<th>Ocular</th>
<th>Dermal</th>
<th>Otic</th>
<th>Inhalation</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>4684 (89.1%)</td>
<td>448 (8.5%)</td>
<td>329 (6.3%)</td>
<td>37 (0.7%)</td>
<td>34 (0.6%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medical Outcome</th>
<th>No effect</th>
<th>Minor effect</th>
<th>Moderate effect</th>
<th>Major effect</th>
<th>Not followed</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>2292 (43.6%)</td>
<td>389 (7.4%)</td>
<td>34 (0.6%)</td>
<td>5 (0.1%)</td>
<td>15 (29.4%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Most Common Clinical effects</th>
<th>Ocular irritation/pain</th>
<th>Vomiting</th>
<th>Red eye</th>
<th>Oral irritation</th>
<th>Drowsiness, lethargy</th>
<th>Cough/choke</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>250 (4.8%)</td>
<td>111 (2.1%)</td>
<td>111 (2.1%)</td>
<td>63 (1.2%)</td>
<td>45 (0.9%)</td>
<td>37 (0.7%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Most Common Treatments</th>
<th>Dilute /irigate/ wash</th>
<th>Food/snack</th>
<th>Activated Charcoal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>3781 (72.0%)</td>
<td>473 (9.0%)</td>
<td>150 (2.9%)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Benzocaine exposures among age 0-5 years, by medical outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>No effect</td>
</tr>
<tr>
<td>Percent</td>
</tr>
</tbody>
</table>

Pediatric benzocaine exposures reported to this poison center network have declined over the past two decades.
Dangers of huffing computer cleaner sprays are hard to dust off

Maria Hinojosa, PharmD1, Shawn M. Varney, MD1, Mathias B. Forrester2

1South Texas Poison Center, UT Health San Antonio, TX; 2Independent Researcher, Austin, TX

Compressed air products marketed as computer and electronic duster sprays contain fluorinated hydrocarbons like difluoroethane or tetrafluoroethane.

Inhalant abuse involves practices known as dusting (inhaling directly) or huffing (inhaling fumes sprayed onto fabric).

Inhalant abuse affects many organ systems; however, the central nervous system is most susceptible.

Complications include frostbite, lethargy, syncope, dysrhythmias, hypoxia, seizures, and sudden death.

This study intended to describe inhalant abuse from computer and electronic duster sprays reported to a statewide poison center network.

Cases commonly involved male patients, aged 13-39 years, had moderate outcomes, but also two deaths were reported.

Computer and electronic duster spray inhalation abuse cases reported 2000-2018, by year

Annual number of computer and electronic duster spray exposures increased from 6 in 2000 to 64 in 2009 and established a new baseline for 2010-2018.

Demographics
- Male: 458 (63.4%)
- Age 13-39 years: 570 (78.9%)

Most common clinical effects
- Tachycardia: 161 (22.3%)
- Drowsiness/lethargy: 89 (12.3%)
- Hypertension: 70 (9.7%)
- Syncope: 67 (9.3%)
- Vomiting: 55 (7.6%)
- Nausea: 51 (7.1%)
- Confusion: 45 (6.2%)
- Agitated/irritable: 44 (6.1%)
- Dizziness/vertigo: 40 (5.5%)

Medical Outcome
- No effect: 112 (15.5%)
- Minor effect: 154 (21.3%)
- Moderate effect: 207 (28.7%)
- Major effect: 34 (4.7%)
- Death: 2 (0.3%)
- Not followed, nontoxic: 4 (0.6%)
- Not followed, minimal: 70 (9.7%)
- Not followed, toxic: 128 (17.7%)
- Unrelated: 11 (1.5%)

Most common treatments
- IV fluids: 165 (22.9%)
- Fresh air: 152 (21.1%)
- Oxygen: 138 (19.1%)
- Dilute/irigate/wash: 43 (6.0%)
- Benzodiazepines: 41 (5.7%)

Conclusion
- Cases commonly involved male patients, aged 13-39 years, had moderate outcomes, but also two deaths were reported.
Background

- Mercury has been used in skin lightening creams and beauty products as it inactivates the melanin production pathway.
- Chronic dermal exposure to inorganic mercury can lead to accumulation in the tissues and eventually cross the blood-brain barrier.
- Clinical effects include neurologic sequelae, gastrointestinal effects, and renal injury.
- This case presents toxicity after chronic dermal exposure to a mercury-containing skin cream.

Case report

- A 43-year-old, healthy female presented to her primary care provider (PCP) with headache and fatigue and reported that she had been using a skin-lightening facial cream from Mexico daily for over one year.
- Her PCP ordered a metals screen. Her serum mercury level was 140 mcg/L and then 137 mcg/L drawn 2 weeks later.
- A toxicology consult was obtained and recommended oral succimer 10 mg/kg every 8 hours for 5 days, then twice daily for 2 weeks. Meanwhile patient reported ongoing dizziness, headache, and cognitive issues for 2-3 weeks before treatment.
- About 8 days into treatment, she was admitted to the hospital for severe headache, anorexia, nausea, diarrhea, myalgias, fatigue, fever, and transiently elevated AST/ALT.
- The hospital lab reported a serum mercury level of 81.2 mcg/L and a 24-hour urine mercury level of 152 mcg/L. The succimer was stopped twice over a 10-day period during admission due to side effects.
- The patient was able to tolerate succimer with diphenhydramine, ibuprofen, and acetaminophen. A subsequent 24-hour urine mercury level was 203 mcg/L.
- After discharge, the patient’s serum mercury level was 54 mcg/L. She completed her succimer therapy, and symptoms resolved.
- Three months later, her serum mercury level declined to 15 mcg/L.

Case discussion

- The compounding pharmacist in Mexico had placed the cream in a name-brand container.
- Our patient used a highly concentrated mercury-laden skin cream for over a year and developed elevated serum and urine mercury levels.
- She reported neurologic symptoms but had no changes in renal function.
- Although unable to speciate the mercury levels, the State Health Services lab determined that the skin cream contained 29,100 ppm of inorganic mercury.
- Our patient experienced adverse effects from chelation treatment that resulted in hospitalization.

Conclusion

- Despite mercury’s known toxicity, it can be found in compounded or adulterated skin care products.
- Our patient became moderately symptomatic via dermal absorption.
- Her levels declined with succimer treatment that required hospital admission for adverse effects.
Analeptic Dose of Flumazenil in a Toddler without Benzodiazepine Exposure

Dr. Rachel Hedstrom
Dr. Ashley Bjorklund
Dr. Abby Montague

Minnesota Poison Control System
Minneapolis, Minnesota

Background
- Flumazenil has few side effects in the benzodiazepine naïve patient
- Analectic effects are reported with “high” doses of flumazenil
- Dose threshold for this effect is unknown
- In this case, we present the possibility of flumazenil acting as an analeptic, or pure wake-up drug, in a pediatric patient with no identified benzodiazepine exposure

Case Report
- Previously healthy 22-month-old male found unresponsive, in setting concerning for illegal drug exposure
- Naloxone given initially with “partial response”
- Sedation and hypoventilation returned 1.5 hours after naloxone
- Total of 5.8mg naloxone given with response in RR but not mental status.
- Flumazenil 0.2mg given with complete arousal
- UDS by MS identified norbuprenorphine and methamphetamine
- Pt had recurrence of symptoms with antidote infusion weaning
  - Naloxone continued to be insufficient to maintain arousal
  - No other substance identified on novel benzodiazepine assay or non-directed testing
  - Child did not require intubation and completely recovered

Case Discussion
- Serial toxicologic and critical care assessments determines that the patient responded to both antidotes
  - Response to 0.018-0.044 mg/kg of flumazenil
  - After advanced toxicology testing yielded no other drug exposure, we concluded flumazenil was acting as an analeptic
  - May be reversing sedation secondary to meth washout, buprenorphine toxicity with insufficient naloxone dose, or concurrent viral illness

Conclusion
- Flumazenil may be inherently analeptic at a dose of .018 mg/kg in a toddler
Cerebral Edema and Brain Death Following Intravenous N-acetylcysteine Overdose

1,2 Riley Hartmann, 2 Sunil Pradhan, 3 Diana Bylyku, 3 Kristine Markieta, 4 James Scozzafava, 3 Scott Lucyk, 3 Mark Yarema
1 Department of Emergency Medicine, University of Calgary, Calgary, Alberta, 2 Department of Emergency Medicine, College of Medicine, University of Saskatchewan, Saskatoon, Saskatchewan, 3 Poison and Drug Information Service, Calgary, Alberta, 4 Department of Adult Critical Care Medicine, Saskatchewan Health Authority, Saskatoon, Saskatchewan

Introduction
- Common adverse effects from N-acetylcysteine (NAC) include nausea, vomiting, and anaphylactoid reactions.
- Two previous cases describe cerebral edema in a 2.5-year-old and 21-year-old having received 2450 mg/kg NAC over 6 hours and 3050 mg/kg NAC over 30 hours respectively.
- We present a case of IV NAC toxicity following the administration of 1242 mg/kg over 8.3 hours resulting in cerebral edema, a herniation syndrome, and death.

Case Presentation
- 17-year-old female (48.3kg)
  - PMHx: Depression, prior overdose on acetaminophen
  - Home Medications: None
  - Ingested 11.5 g (238.1 mg/kg) acetaminophen at an estimated 1 hour prior to arrival to a community emergency department. Denied other co-ingestions.
  - Upon arrival, had nausea and is vomiting pill fragments. Charcoal is not administered.
- Initial Vitals:
  - T: 36.8 C HR: 99 BPM BP: 111/74 mmHg RR: 18/min O2 Sat: 99% on 40% FiO2 PEEP 20
- Normal physical exam without right upper quadrant pain or tenderness
- Initial Work-up:
  - 2 Hour [APAP]: 135.5 ug/mL (896.1 umol/L)
  - 4 Hour [APAP]: 89.5 ug/mL (591.8 umol/L)
  - 8 Hour [APAP]: 46.7 ug/mL (309 umol/L)
  - ALT: 16 AST: 21 LDH: 276 GGT: 18 Lipase: 40
  - Total Bil: 0.7 mg/dL Ammonia: 58.8 ug/dL (42 umol/L)
  - INR: 1.0 APTT: 36
  - ETOH, Ethylene Glycol, Methanol, Isopropyl alcohol and Salicylate: Undetectable
  - Iron: 50.2 ug/dL (9 umol/L)
- Given the uncertainty surrounding the time of ingestion and known time last seen normal being several hours prior, IV NAC therapy was recommended once the local poison centre was contacted

Case Presentation (continued)

<table>
<thead>
<tr>
<th>Time Frame (Hours post-ingestion)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0 10 20 30 40 50 60 70 80</td>
</tr>
<tr>
<td>Mayo Clinic contacted and NAC Ordered: 150 mg/kg over 1 hour then 15 mg/kg for 20 hours</td>
</tr>
</tbody>
</table>
Arrange care for elevated ICP including sedation, coverage for vital and bacterial meningitis, hyperosmotic therapy, and EVD ICP monitoring

Condition during NAC Therapy
- Patient experienced worsening, resistant nausea and vomiting
  - Treated with:
    - 50 mg dimenhydrinate IV
    - 4 mg ondansetron IV

Medication Error
- Medication error discovered when second 30 mg/mL IV NAC bag finished.
  - Error due a combination of:
    - Cognitive factors (verbal hand over to “extend the infusion”)
    - System factors (overriding pump system software to allow for 150 mg/kg/hr infusion)
- Failure to recognize adverse reactions due to IV NAC including intractable nausea and vomiting

Discussion
- Our patient received 1242.2 mg/kg NAC over 8.3 hours. This is the lowest quantity associated with cerebral edema in the literature.
- Naranjo score of 6 indicated a probable adverse drug event
- Potential mechanisms include:
  - Intracerebral accumulation of osmotically active NAC solution
  - Increased glutaminergic signaling → seizures and edema
- Take Home Points:
  - Clinical features of NAC toxicity include: anaphylactoid reactions, nausea, intractable vomiting, altered mental status and seizures
  - Clinicians must be suspicious for possible medication administration errors in patients not responding as expected

References

Acknowledgments
- We would like to thank all the poison information specialists, medical toxicologists, attending physicians and other health professionals involved in this case.

Contact name: Riley Hartmann
Email: rjh110@mail.usask.ca
Successful Management of Monocled Cobra (Naja kaouthia) envenomation with Neuro Polyvalent Antivenin

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BACKGROUND

While a monovalent antivenin specific to the Monocled Cobra (Naja kaouthia) exists and is frequently used in treatment of these envenomations, there are no reports of the use of the broader Thai Red Cross Society Neuro Polyvalent Snake Antivenin (NPAV) (Queen Saovabha Memorial Institute) in human envenomations by Naja kaouthia. Venom of the Naja species exhibit varying levels of cardiotoxicity, hemotoxicity, and neurotoxicity, and patients often present with neurologic symptoms including ptosis, respiratory difficulty, and weakness. Duration and severity of hematologic, cardiac, and neurologic symptoms are improved by prompt administration of antivenin.

CASE REPORT

The patient was a 32-year-old male who presented to an outside hospital approximately 1 hour after being bitten by his sibling’s female monocled cobra. Shortly after arrival, he began to have difficulty breathing. He was administered succinylcholine and etomidate and intubated. He was placed on propofol and fentanyl for sedation and sent via helicopter to the tertiary care center. On evaluation, patient was intubated and sedated. Two punctate fang marks were noted to the left thumb with mild tissue edema of the hand.

Initial labs showed hematocrit 37.9 %, platelet count of 153,000/uL, INR 1.1, and fibrinogen 352 mg/dL. He was given 8 vials of NPAV upon arrival to the ED without any adverse reactions, and was admitted to the intensive care unit. Repeat labs that afternoon showed hematocrit 39.7 %, platelet count of 264,000/uL, INR 1.2, and fibrinogen 223 mg/dL. He was extubated approximately 36 hours after his envenomation with improvement in hand edema and no signs of local tissue necrosis. His symptoms resolved completely. He was discharged 24 hours later in good condition.

CASE DISCUSSION

Purified equine Naja kaouthia antivenin is frequently used in the management of Naja envenomations. NPAV has been shown to effectively neutralize various venoms in vitro, including those of the Naja and Bungarus species. The end result is a much quicker time to resolution of clinical findings, and lower morbidity and mortality, than in cases in which antivenin is not used. We were unable to find any cases that reported the use of of this NPAV in envenomation of humans by Naja kaouthia.

CONCLUSIONS

We report here the first successful use of Thai Red Cross Society Neuro Polyvalent Antivenin in the management of a Naja kaouthia envenomation in a human. While envenomation by crotalid spp is more common in the United States, providers should be aware of management options for exotic snakes given they are often kept in zoos or by private collectors.
A non-surgical approach to management of lepidopterism following ingestion of a woolly bear caterpillar (*Pyrrharctia isabella*)

Laurie Seidel Halmo1,2, Taylor G. Lackey3, Sarah A. Gitomer3, Jeffrey Brent4

1Rocky Mountain Poison & Drug Safety - Denver Health and Hospital Authority; 2Department of Pediatrics, University of Colorado - Children’s Hospital Colorado; 3Department of Otolaryngology, University of Colorado; 4University of Colorado School of Medicine
A non-surgical approach to management of lepidopterism following ingestion of a woolly bear caterpillar (*Pyrrharctia isabella*)

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**Introduction**

- **Lepidopterism** refers to the development of systemic symptoms following exposure to members of the Lepidoptera order (moths, butterflies, and their larvae)
- Oropharyngeal contact with urticating setae (hairs) may lead to airway obstruction
- Prior reports describe extensive efforts—including direct laryngoscopy, bronchoscopy, and esophagoscopy—to remove setae

**Case Report**

- A 19-month-old male presented with inconsolability and emesis but no difficulty breathing immediately following ingestion of half of a dead woolly bear caterpillar (Fig 1)
- Exam notable for embedded setae in lips, oral mucosa, and right tonsil, without edema
- Bedside flexible laryngoscopy revealed a single seta embedded in the epiglottis (Fig 2)

**Figures**

![A woolly bear caterpillar (*Pyrrharctia isabella*)](image1)

![A single seta (arrow) embedded in the patient’s epiglottis without appreciable edema](image2)

**Case Report**

- Received 24 hours of steroids followed by an additional 24 hours of observation
- Maintained adequate oral intake
- No visible setae and mild tonsillar edema noted at follow up one week later – resolved at subsequent follow up the next week

**Discussion**

- One other case of woolly bear caterpillar ingestion reported: required laryngoscopy, intubation in an operating room after edema developed following attempted setae removal
- In our case, setae fell out reasonably quickly

**Conclusions**

- Patients with lepidopterism without airway distress who tolerate oral intake do not uniformly require setae removal
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Department of Emergency Medicine at Strong Memorial Hospital and the University of Rochester Medical Center, Rochester, NY, USA

Susie Q to ‘Come Down’ from K2: an Interesting Constellation of Symptoms in an Incarcerated Individual

Case Report
- **Presentation**
  - 18 year-old male incarcerated for several months found unresponsive after standing, feeling dizzy, and falling, hitting his head on cell bars. Unconscious for 10 minutes with ‘rhythmic jerking’ reported
  - Two week of nausea, vomiting and diarrhea
  - Meds: metformin, ondansetron, Lisinopril
  - PMH of Diabetes, Morbid obesity, HTN and GERD; no history of seizures
- **Emergency department course & assessment**
  - Initial VS: HR 60 bpm, BP 103/51 mmHg, T 35.5°C
  - 2 hours in the ED and patient was lethargic, mildly hypotensive and bradycardic, but awakens to voice and is able hold full conversations in between falling asleep
    - VS:HR 57 bpm, BP 99/75 mmHg
    - Glucose 60
    - EKG demonstrated sinus bradycardia - HR 51 bpm & QT of 440 ms
    - Mild hypotension/bradycardia responded to atropine 0.5 mg x 1
    - Acute kidney injury
    - Cr 3.54, BUN 33, anion gap of 26, bicarbonate 18
    - Patient remained lethargic and hypotensive despite 2 L IVF bolus
    - Foley placed for urine sample
    - ETOH < 10 mg/dL, APAP and ASA negative and UDS negative
- **Admitted to PICU**
  - Intubated overnight for brief period
  - Head CT negative
  - Norepinephrine briefly administered for persistent hypotension that resolved within hours
  - Toxicology, Cardiology, Neurology and Endocrinology all consulted
  - Toxicology: Susie Q
  - Patient admitted to use of K2 after toxicity questioning
  - Reported quetiapine from ‘poker friend’

Discussion
- **Quetiapine (Seroquel®) or “Susie Q” Intoxication**
  - Atypical antipsychotic and antagonist at dopamine, serotonin, and adrenergic receptors
  - Intoxication results in sedation, coma, hypotension, miosis, QT prolongation along with anticholinergic effects
- **Synthetic cannabinoids (SC) or “K2” Intoxication**
  - Intoxication includes agitation, psychosis, tachycardia, seizures, and hallucinations presentations vary by specific cannabinoid type and co ingestions
  - Newer generation SCs have also presented with bradycardia, hypoglycemia and coma among other symptoms.

Conclusion
- Case highlights the misuse of prescribed medication in an incarcerated individual
- Abuse of prescription drugs is common in the criminal justice system with predominant drugs changing according to availability
- SC’s are also frequently abused because they are difficult to detect in standard urine screens, more potent than cannabis and easy to smuggle in.
- Uncommon symptoms occurred altogether in this patient prompting extensive workup but essentially the patient ingested quetiapine to ‘come down’ from K2 intoxication resulting in toxicity leading to hospitalization.
- By understanding patterns of abuse and the drugs that are available to special populations we can better predict and then mitigate misuse, more effectively limiting complications from use including overdose. Additionally, it may result in more appropriate use of psychiatric medications in incarcerated individuals.

Limitations
- Single patient case report

**Case Report**

- Presentation
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  - By understanding patterns of abuse and the drugs that are available to special populations we can better predict and then mitigate misuse, more effectively limiting complications from use including overdose. Additionally, it may result in more appropriate use of psychiatric medications in incarcerated individuals.

**Limitations**

- Single patient case report
Young Acute Coronary Syndrome and Recreational Drug Use: an Amsterdam-based retrospective study

F.M.J. Gresnigt, MD, M. Hulshof, E.J.F. Franssen Pharm. D, D.W. de Lange, MD, R.K. Riezebos, MD

Background
Cocaine use is a well-established risk factor for cardiac events. Additionally, other recreational drugs (RD), are proposed as potential cardiac risk factors, however evidence is limited. A worse cardiovascular and all-cause outcome has been described for RD-associated acute coronary syndrome (ACS), compared to ACS without RD use.

Aim
The aim of this study was to explore RD use in a contemporary cohort of young ACS patients.

Methods
Between June 2016 and October 2019, ACS patients aged 18 to 50 years, whom presented at the OLVG hospital in Amsterdam, were retrospectively included for analysis. Medical chart review to obtain RD use, patient and clinical characteristics, cardiac risk factors, outcome and follow up was performed.

Table 1. Numbers and frequencies of recreational drugs among ACS patients

<table>
<thead>
<tr>
<th>Recreational Drug</th>
<th>(N = 57, 24.9%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cannabis</td>
<td>37 (16.1%)</td>
</tr>
<tr>
<td>Cocaine</td>
<td>11 (4.8%)</td>
</tr>
<tr>
<td>Cannabis + cocaine</td>
<td>6 (2.6%)</td>
</tr>
<tr>
<td>Cannabis oil</td>
<td>1 (&lt;1%)</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>1 (&lt;1%)</td>
</tr>
<tr>
<td>Methamphetamine + Amphetamine</td>
<td>1 (&lt;1%)</td>
</tr>
</tbody>
</table>

Results
Despite standard protocol to subject ACS patients < 50 years old to a urine toxicology screening (TST-U) and extensive attention for the importance for taking a recreational drug history in our hospital, 52.1% of young ACS patients did not have a RD history recorded or TST-U performed. Therefore, from 478 eligible patients, a total of 229 patients were included in the study. Recreational drug use prior to ACS was present in 24.9% of all included patients, with cannabis (16.2%) and cocaine (4.8%) most commonly observed. Three other patients were identified, the first patient, without any cardiovascular risk factors, used cannabis oil prior to ACS. The other two patients had considerable cardiovascular risk factors, and developed ACS after methamphetamine mono-ingestion or amphetamine and methamphetamine co-ingestion. Recreational drug users were predominantly young men (87.7%), and tobacco use was significantly higher in RD users compared to non-users (OR 7.41, 2.19-25.0 95% CI, P=0.001). Other cardiac risk factors were similar.

After cocaine use, the systolic blood pressure (132 vs 141 mmHg), diastolic blood pressure (85 vs 87 mmHg) and heart rate (79 vs 77/minute) on admission were not different compared to the non-RD using young ACS patients. Compared to non-users, RD-users demonstrated significantly higher levels of peak CK-MB (104 U/L ± 116 vs 62 U/L ± 96, P = 0.041) and cannabis associated ACS patients also demonstrated significantly higher peak hs-cTn levels (30.9ng/L ± 55.0 vs 17.8ng/L ± 162.2 (10log-transformed), P = 0.44). On coronary angiogram all cocaine related ACS patients showed coronary artery disease.

Conclusion
Data on recreational drugs (RD) was available in almost half the young ACS patients. Of these patients almost 25% had recently used RD, most commonly cannabis and cocaine. Patients with RD related ACS had high cardiovascular risk profiles compared to non-RD patients, mostly due a higher prevalence of smoking. Furthermore, although a causal relationship cannot be determined, our findings suggest that RD-users had larger myocardial injury.

References
Background: A randomized clinical trial recently demonstrated that patients treated with antivenom recover faster from copperhead (Agkistrodon contortrix) envenomations than subjects treated with placebo. The purpose of this study was to see if there was a similar benefit in the adolescent population and to compare recovery in adolescents versus adults.

Methods: This is a secondary analysis of a multi-center, randomized, double-blind, placebo-controlled trial assessing the efficacy of Crotalidae polyvalent immune Fab (ovine) (CroFab; FabAV) in the management of copperhead envenomations. The primary outcome for this analysis was limb function at 14 days post-envenomation, measured by the Patient Specific Functional Scale (PSFS). Secondary outcomes included PSFS score at other times, time to achieve full recovery, and analgesic requirements.

Results: There were eight adolescent subjects in the original trial. Three were treated with FabAV and five were assigned to the placebo group. The primary outcome, the mean PSFS at day 14, was 8.5 for the placebo group versus 8.9 for the Fab AV group. Adolescents recovered faster than the adult subjects in the original trial, particularly in subjects randomized to the placebo group. The median PSFS for untreated adolescents at 14 days was 8.5, compared to 7.4 in adult subjects. No adolescents had hematotoxicity or required surgical intervention.

Conclusions: Adolescent copperhead envenomation patients have a similar clinical course to adults but with slightly faster improvement. Antivenom appears to accelerate recovery and decrease opioid usage.
Background: There are 5,000 – 10,000 emergency department (ED) visits for snakebites annually in the United States (U.S.). Bites from non-native snakes are uncommon, accounting for 1.1% of envenomations reported to poison centers between 2012 – 2018. Here we discuss a N. kaouthia envenomation resulting in local tissue injury and respiratory failure.

Case report: A previously healthy 30-year-old male was bitten by his captive monocled cobra at 1900 while performing routine enclosure maintenance (Figure 1). The patient contacted the regional snakebite expert, who coordinated with the local zoo to provide Thai Red Cross (TRC) cobra antivenom. At the first hospital, he was noted to be mildly hypotensive, bradycardic, and confused. His hand was swollen and ecchymotic. His breathing seemed labored, so he was intubated using midazolam, etomidate, and rocuronium. His blood pressure and heart rate improved, and he did not require vasopressors or atropine. He was then transferred via helicopter air ambulance to a quaternary care center near the zoo. He remained hemodynamically stable in flight. He arrived at the receiving facility at 2300 with the following vital signs: Heart rate 80, blood pressure 211/119 mm Hg, rectal temperature of 97.1° F, and his oxygen saturation was 96% while on the ventilator. His exam was notable for two small puncture wounds to the right third digit and significant swelling extending from the hand to the forearm. His laboratory studies were unremarkable. In the ED, five vials of TRC cobra antivenom were administered over one hour. The swelling continued to extend proximally to the middle of the arm. No necrosis or discoloration was noted. The affected extremity was elevated, and the patient was admitted to the medical intensive care unit (MICU) at 0340. One hour later the patient had an additional bradycardic episode to the 20s that corrected with 1 mg of atropine. The remainder of his ICU course was uncomplicated. He was extubated 35 hours after the envenomation. He was noted to have a large blister at the bite site (Figure 2). He requested discharge, so he was observed for an additional nine hours before going home, where he has recovered without incident.

Case Discussion: Envenomations following N. kaouthia bites are characterized by local tissue injury and various neurotoxic effects, including respiratory and skeletal muscle weakness. Nonspecific signs and symptoms such as headache, vomiting, diarrhea, and dizziness are common. Hematologic toxicity is rare. Cardiovascular manifestations, e.g. hypotension, bradycardia, are not typical of N. kaouthia envenomations. Our patient’s bradycardia and hypotension were likely secondary to vagal stimulation. Conversely, the transient elevated blood pressure was likely due to anxiety and discomfort. Antivenom is the specific treatment for snake envenomation, and there are several that are approved for N. kaouthia.

Cholinesterase inhibitors may reduce toxicity from post-synaptic alpha toxins by increasing acetylcholine concentrations.

Conclusion: Healthcare providers should be prepared to treat local and neurological manifestations following N. kaouthia envenomations with supportive care and one of the recommend antivenoms.
Epidemiology, Clinical Features, and Management of Texas Coral Snake (*Micrurus tener*) Envenomations Reported to the North American Snakebite Registry

Spencer Greene, MD, MS¹,²; Anne-Michelle Ruha, MD³; Sharan Campleman, PhD⁴; Jeffrey Brent, MD, PhD⁵; Paul Wax, MD⁶ on behalf of the ToxIC Snakebite Study Group

**Background:** There are 5,000 – 8,000 snakebites reported to poison control centers (PCCs) annually in the United States (U.S.), but very few are attributed to coral snakes. Clinical manifestations following a coral snake bite may vary depending on the species involved. This study describes the epidemiology, clinical effects, and management of Texas coral snake envenomations using prospective data reported to the North American Snakebite Registry (NASBR), administered by the American College of Medical Toxicology (ACMT).

**Methods:** Data collected in the NASBR include details on the snakebite encounter, patient demographics, circumstances of the envenomation, clinical presentation, diagnostic or laboratory tests, treatment, and any outpatient follow-up or re-admissions post-discharge. For this report, all Texas coral snake (*Micrurus tener*) envenomation cases reported to NASBR were identified for the period from January 1, 2015 through December 31, 2019. Data reviewed for this study included details regarding the snake encounter, patient demographics, local and systemic signs and symptoms, treatment, and outcomes. Descriptive statistics were used to report results.

**Results:** Fourteen Texas coral snake bites were reported to the NASBR. Ten men and four non-pregnant women reported coral snake bites. Nine (64%) patients were younger than 18 years old, with ages ranging from 5 – 72 years old (median 15.5 years old). There were 12 patients with upper extremity bites and two with bites to the lower extremity. Circumstances of the snake encounters are described in Table 1. All but one of the bites occurred in the wild. Two patients had a history of prior snakebites and were the only two with a history of illicit substance abuse. Three subjects reported alcohol use, but none were intoxicated at the time of the bite. Tobacco use was reported in one subject. The most common symptoms reported were paresthesias and pain. All subjects had paresthesias, often described as an "electric" sensation. Seven patients described them as painful, and three rated the pain as "severe". The most common clinical findings were erythema and swelling. No patient developed tissue damage (Table 2). There were no cases of hematotoxicity, rhabdomyolysis, hypotension, or respiratory symptoms. No patient had any objective weakness. Thirteen subjects were treated with opioids. Six patients were treated with antiemetics: three prophylactically and two for opioid-induced nausea. One patient developed nausea and non-bloody, nonbilious emesis within one hour of the bite, prior to receiving opioids. No patients were treated with antivenom. Antibiotics were not administered to any patient, and no infections were reported.

**Conclusions:** Envenomations from *M. tener* in Southeast Texas are characterized by paresthesias that are often painful. Mild swelling and erythema at the envenomation site are also common. Neurotoxicity necessitating intervention with antivenom or mechanical ventilation did not occur in this small, single-investigator study.
The purpose of this study was to better characterize the incidence and severity of late coagulopathies (recurrent and delayed) for rattlesnake envenomated patients treated with Crotalidae Polyvalent Immune Fab antivenom (FabAV).

BACKGROUND
Arizona is home to more species of North American rattlesnakes than any other state, with an estimated 250,500 people envenomated each year.

Toxicity after Rattlesnake Envenomation
• Cytotoxicity: Tissue damage, swelling, pain
• Neurotoxicity: Possible fasciculations in the nearby muscle, angioedema, metallic taste
• Hematologic toxicity: Hemorrhagic changes at the site, thrombocytopenia, hypofibrinogenemia

Therapy with crotalidae polyvalent immune fab (antivenom) begins with a 6 vial bolus, which can be repeated until symptoms are controlled.

METHODS
This was a retrospective chart review; all rattlesnake exposures occurring between 2013 to 2016 treated with FabAV and managed by the APDIC.

INCLUSION CRITERIA:
• Rattlesnake envenomation in a human
• Initial control of venom effects achieved with FabAV with or without maintenance dosing
• Laboratory follow up after antivenom discontinuation

EXCLUSION CRITERIA:
• No antivenom given
• Past medical history of coagulation abnormality or receiving home anticoagulation
• No laboratory follow up
• Persistent coagulopathy (developed coagulopathy and never returned to normal after antivenom administration)

OUTCOMES:
Coagulopathy defined as, 1 or more of the following:
• INR > 1.5
• Plasma fibrinogen < 150 mg/dL
• Platelets < 150,000/mm³
• Late coagulopathy: developing after completion of antivenom with or without maintenance doses
• Recurrent coagulopathy: initial coagulopathy occurred and resolved
• Delayed coagulopathy: no initial coagulopathy

CONCLUSION
• Late coagulopathy can be expected in at least 50% of patients treated with FabAV after a rattlesnake envenomation.
• Recurrent coagulopathy can be delayed up to 11 days.
• Delayed coagulopathy can be delayed up to 14 days.
• Recurrent coagulopathy most commonly presents with the same as the initial coagulopathy but not always.
• Retreatment rates are low; however, there is a risk of bleeding.
• When treating rattlesnake envenomations with FabAV, we recommend laboratory follow up from 5-14 days to ensure late coagulopathy is assessed.

DEFINITIONS OF LATE COAGULOPATHY
Coagulopathy defined as, 1 or more of the following:
• Recurrent coagulopathy: initial coagulopathy occurred and resolved
• Delayed coagulopathy: no initial coagulopathy

RESULTS

<table>
<thead>
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<th>Total Bites Reported</th>
<th>Recurrent (n=77)</th>
<th>Delayed (n=71)</th>
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<tr>
<td>n=644</td>
<td>21 (27%)</td>
<td>25 (35%)</td>
</tr>
<tr>
<td>&lt;50</td>
<td>34 (44%)</td>
<td>18 (25%)</td>
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<thead>
<tr>
<th>Fibrinogen</th>
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<td>50 - 150</td>
<td>21 (27%)</td>
<td>25 (35%)</td>
</tr>
<tr>
<td>&lt;50</td>
<td>34 (44%)</td>
<td>18 (25%)</td>
</tr>
</tbody>
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<table>
<thead>
<tr>
<th>Platelets</th>
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<th>Delayed (n=71)</th>
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<tr>
<td>100 - 150,000</td>
<td>31 (40%)</td>
<td>30 (42%)</td>
</tr>
<tr>
<td>50-100,000</td>
<td>13 (17%)</td>
<td>8 (11%)</td>
</tr>
<tr>
<td>&lt; 50,000</td>
<td>5 (6%)</td>
<td>4 (6%)</td>
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<table>
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<th>Other Coagulopathy</th>
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<tr>
<td>INR &gt; 1.5</td>
<td>38 (49%)</td>
<td>20 (28%)</td>
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<tr>
<td>Mixed coagulopathy</td>
<td>29 (38%)</td>
<td>15 (21%)</td>
</tr>
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<table>
<thead>
<tr>
<th>Onset &amp; Retreatment</th>
<th>Recurrent (n=77)</th>
<th>Delayed (n=71)</th>
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<tbody>
<tr>
<td>Avg. Onset – Fib.</td>
<td>5.1 Days (1-10)</td>
<td>6.3 Days (1-14)</td>
</tr>
<tr>
<td>Avg. Onset – Plts.</td>
<td>5.4 Days (1-11)</td>
<td>7.2 Days (1-12)</td>
</tr>
<tr>
<td>Patients Retreated</td>
<td>19</td>
<td>5</td>
</tr>
<tr>
<td>Avg. AV Administered</td>
<td>6 Vials (2-26)</td>
<td>6.8 Vials (2-12)</td>
</tr>
</tbody>
</table>
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Therapy with crotalidae polyvalent immune fab (antivenom) begins with a 6 vial bolus, which can be repeated until symptoms are controlled. Two vial maintenance doses are then given every 6 hours for 3 doses. Despite adequate therapy, symptoms can recur weeks after envenomation, possibly due to antivenom's relatively short half-life compared to venom.

Prior research has had conflicting information. One study of 38 patients concluded the initial coagulopathy predicted a recurrent coagulopathy and if there was no coagulopathy in the beginning there would be no delayed coagulopathy. A larger study with 66 patients showed that recurrent coagulopathies differed from the original coagulopathy and there is evidence of delayed coagulopathy.

While serious bleeding complications rarely occur with late coagulopathies, there have been and the risk does exist. There are currently no predictors of who will have a significant event.

**METHODS**

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**Inclusion Criteria:**
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- Initial control of venom effects achieved with FabAV with or without maintenance dosing
- Laboratory follow up after antivenom discontinuation

**Exclusion Criteria:**
- No antivenom given
- Past medical history of coagulation abnormality or receiving home anticoagulation
- No laboratory follow up
- Persistent coagulopathy (developed coagulopathy and never returned to normal after antivenom administration)

**Outcomes:**
- Coagulopathy defined as, 1 or more of the following:
  - INR > 1.5
  - Plasma fibrinogen < 150 mg/dl
  - Platelets < 150,000/mm^3
- Late coagulopathy: developing after completion of antivenom with or without maintenance doses
- Recurrent coagulopathy: initial coagulopathy occurred and resolved
- Delayed coagulopathy: no initial coagulopathy

**RESULTS**

**Total Bites Reported**
- N=644
- Excluded N=357
- Included N=287

**Coagulopathy**
- Initial Coagulopathy
  - 213 (30%)
- Late Coagulopathy
  - 148 (52%)
- Recurrent
  - 77 (52%)
- Delayed
  - 71 (48%)

**Definitions of Late Coagulopathy**

**Envenomation Timeline**

**DEFINITIONS OF LATE COAGULOPATHY**

- Same as Initial
  - 57 (74%)
- Different from Initial
  - 20 (26%)

**Fibrinogen**
- Recurrent (n=77)
  - 50 - 150
    - 21 (27%)
    - 25 (35%)
- Delayed (n=71)
  - <50
    - 34 (44%)
    - 18 (25%)

**Platelets**
- Recurrent (n=77)
  - 100 - 150,000
    - 31 (40%)
    - 30 (42%)
- Delayed (n=71)
  - < 50,000
    - 5 (6%)
    - 4 (6%)

**Other Coagulopathy**
- INR > 1.5
  - Recurrent (n=77)
    - 38 (49%)
    - 20 (28%)
- Mixed coagulopathy
  - 29 (38%)
  - 15 (21%)

**Onset & Retreatment**
- Recurrent (n=77)
    - 5.1 Days (1-10)
    - 6.5 Days (1-14)
    - 5.4 Days (1-11)
    - 7.2 Days (1-12)
- Patients Retreated
  - 19
  - 5
- Avg. AV Administered
  - 6 Vials (2-26)
  - 6.8 Vials (2-12)

**CONCLUSION**

- Late coagulopathy can be expected in at least 50% of patients treated with FabAV after a rattlesnake envenomation.
- Recurrent coagulopathy can be delayed up to 11 days.
- Delayed coagulopathy can be delayed up to 14 days.
- Recurrent coagulopathy most commonly presents with the same as the initial coagulopathy but not always.
- Retreatment rates are low; however, there is a risk of bleeding.
- When treating rattlesnake envenomations with FabAV, we recommend laboratory follow up from 5-14 days to ensure late coagulopathy is assessed.
Background
• A patient with diabetic ketoacidosis was incidentally found to have a markedly elevated ethylene glycol level
• This prompted additional workup and consideration of fomepizole administration

Case Report
• A 55 year old male presented to the Emergency Department with a dislodged tracheostomy, altered mental status, and a severe anion gap metabolic acidosis
• PMH: alcohol abuse, Type 1 Diabetes, previous admissions for diabetic ketoacidosis
• Toxic alcohol levels were ordered as part of the patients AGMA workup
• Ethylene Glycol (EG) resulted at 149 mg/dL. Methanol, ethanol and isopropanol were not detected
• Venous lactate at the time of the EG level was 9.4 mmol/L.
• The patient and his roommate denied ingestion of any toxic alcohols
• Toxicology service was consulted and opted to not treat with fomepizole based on a likely falsely elevated EG via enzymatic assay, and recommended to order a second EG level with additional confirmation at a reference lab via GCMS

<table>
<thead>
<tr>
<th>Laboratory Test</th>
<th>Serum Level</th>
<th>Reference Range</th>
</tr>
</thead>
<tbody>
<tr>
<td>Sodium (Na⁺)</td>
<td>138 mEq/L</td>
<td>135-145 mEq/L</td>
</tr>
<tr>
<td>Potassium (K⁺)</td>
<td>5.1 mEq/L</td>
<td>3.5-5 mEq/L</td>
</tr>
<tr>
<td>Chloride (Cl⁻)</td>
<td>84 mEq/L</td>
<td>98 – 106 mEq/L</td>
</tr>
<tr>
<td>CO2</td>
<td>&lt; 7 mEq/L</td>
<td>23 - 28 mEq/L</td>
</tr>
<tr>
<td>BUN</td>
<td>14 mg/dL</td>
<td>8-20 mg/dL</td>
</tr>
<tr>
<td>Serum Creatinine (SCr)</td>
<td>1.53 mg/dL (Baseline 0.6-0.9 mg/dL)</td>
<td>0.7 – 1.3 mg/dL</td>
</tr>
<tr>
<td>Glucose</td>
<td>245 mg/dL</td>
<td>70 – 100 mg/dL</td>
</tr>
<tr>
<td>Venous Lactate (admission)</td>
<td>17.2 mmol/L</td>
<td>0.5 – 2.2 mmol/L</td>
</tr>
<tr>
<td>Anion Gap</td>
<td>47</td>
<td>8 – 16</td>
</tr>
<tr>
<td>pH (VBG)</td>
<td>7.04</td>
<td>7.36 – 7.44</td>
</tr>
<tr>
<td>pCO2</td>
<td>16 mmHg</td>
<td>35 – 45 mmHg</td>
</tr>
<tr>
<td>pO2</td>
<td>50 mmHg</td>
<td>80 – 100 mmHg</td>
</tr>
<tr>
<td>HCO3⁻</td>
<td>4 mEq/L</td>
<td>23 – 28 mEq/L</td>
</tr>
<tr>
<td>Base Excess</td>
<td>-24 mmol/L</td>
<td>-3 – 2 mmol/L</td>
</tr>
<tr>
<td>Beta Hydroxybutyrate</td>
<td>11.21 mmol/L</td>
<td>0.02 – 0.27 mmol/L</td>
</tr>
<tr>
<td>Ethylene Glycol 1</td>
<td>149 mg/dL</td>
<td>&lt;10 mg/dL</td>
</tr>
<tr>
<td>Ethylene Glycol 2</td>
<td>101 mg/dL</td>
<td>&lt;10 mg/dL</td>
</tr>
<tr>
<td>Venous Lactate (at time of EG 1)</td>
<td>9.4 mmol/L</td>
<td>0.5 – 2.2 mmol/L</td>
</tr>
</tbody>
</table>

Discussion
• The Catachem VetSpec™ Ethylene Glycol Kit is an enzymatic assay that utilizes glycerol dehydrogenase as the reagent to convert EG to glycoaldehyde, with the concomitant reduction of NAD⁺ to NADH.
• The formation of NADH measured spectrophotometrically, correlates with the EG level, which is reported as the result.
• There are known interferences with this assay:
  1. elevated serum lactate can falsely elevate EG due to the oxidation of lactate to pyruvate by lactate dehydrogenase which also produces NADH.
  2. Propylene glycol is a common excipient in medications, and is also known to cause a false elevation of EG.
• There have been previous case reports describing falsely elevated EG levels due to these interferences, however levels in these cases were relatively low; the highest reported level being 46 mg/dL.
• This case identifies that a falsely elevated EG level can be much higher than previously reported.

Conclusion
• A false elevation of EG can lead to unnecessary workup, inappropriate antidotal administration or even dialysis
• We report a significantly elevated EG level via enzymatic assay confirmed negative by GCMS
• This is likely due to interference from the elevated serum lactate level
• Clinicians should be aware of the methodology of toxic alcohol assays at their home institutions and their associated limitations prior to instating interventions
An Increase in Preteen Suicide Attempts by Drug Overdose in the Past Decade

Alfredo Gonzalez, DNP, ENP, Darelle Hinson, MSN
South Texas Poison Center, University of Texas Health San Antonio

Objective

➢ According to Centers for Disease Control and Prevention (CDC) the number of suicides in the United States has risen by 25% over the last two decades.

➢ Suicide is the 10th leading cause of death in the United States with approximately 123 suicides a day.

➢ One national survey estimated that 0.5% of adults aged 18 or older made at least one suicide attempt.

➢ Rates of suicide attempts vary depending on demographic characteristics such as gender, ethnicity, race, and age.

➢ Every year 12,000 children aged 5-14 years old are admitted to psychiatric hospitals for suicidal behavior.

➢ Children as young as six years of age have attempted suicide by overdose.

➢ There are many reasons why teens and preteens attempt and commit suicide; mental illness as well as environmental causes.

➢ Environmental causes include: bullying, cyber bullying, sexual & physical abuse.

➢ Mental causes include: depression, bipolar disorder, borderline personality, eating disorders, feelings of worthlessness and hopelessness.

➢ Preteens are impacted by family conflict while teenagers are affected by relationship conflicts.

➢ The purpose of this research is to determine if there has been an increase in suicide attempts by preteens by overdosing between the ages of 6 and 12 years of age over the last decade.

Method

➢ Poison centers collect demographical data on individuals who attempt or commit suicide

➢ A review research data from the last ten years was conducted on suicide attempts from 6 regional poison centers (10%) of the poison centers in the United States.

➢ The survey included suicide attempts between the ages of 6-12 years of age. The study will document the percent increase or decrease of suicide attempts in pre-teens for the last decade.

➢ The study will document the percent increase or decrease of suicide attempts in pre-teens for the last decade.

Results

➢ Statistical data collected from 6 regional poison centers from 2009-2019 show a percentage increase in suicide attempts in our surveyed research age category of 6-12 years of age.

➢ The percentage increase by each year of age are as follows: 6 y/o: 21.7%, 7 y/o: 28.3%, 8 y/o: 17.8%, 9 y/o: 55.1%, 10 y/o: 21.3%, 11 y/o: 18.9% and 12 y/o: 18.6%.

<table>
<thead>
<tr>
<th>% increase in suicide attempts 2009-2019</th>
</tr>
</thead>
<tbody>
<tr>
<td>6 year olds</td>
</tr>
<tr>
<td>↑ 21.7%</td>
</tr>
<tr>
<td>7 year olds</td>
</tr>
<tr>
<td>↑ 28.3%</td>
</tr>
<tr>
<td>8 year olds</td>
</tr>
<tr>
<td>↑ 17.8%</td>
</tr>
<tr>
<td>9 year olds</td>
</tr>
<tr>
<td>↑ 55.1%</td>
</tr>
<tr>
<td>10 year olds</td>
</tr>
<tr>
<td>↑ 21.3%</td>
</tr>
<tr>
<td>11 year olds</td>
</tr>
<tr>
<td>↑ 18.9%</td>
</tr>
<tr>
<td>12 year olds</td>
</tr>
<tr>
<td>↑ 18.6%</td>
</tr>
</tbody>
</table>

Conclusion

➢ The data reviewed from six regional poison centers over the past decade showed an increase in suicide attempts by overdose in children between the ages of six and twelve years of age.

➢ The findings are consistent with the statistics published by the CDC for the national statistics on suicide.

➢ Data presented support the hypothesis of increased rate of pre-teen suicide attempts during the past decade.
Background

- Acetaminophen (APAP) is a commonly used antipyretic and analgesic medication used for adults and children.
- APAP can be dispensed alone or in combination with other products (opioids, analgesics, sedatives, decongestants, expectorants, and antihistamines), and can be administered by intravenous, oral, and rectal routes.
- APAP has a wide therapeutic index and a wide margin of safety yet it is the drug overdose most frequently reported to the poison centers.
- APAP overdose is the most common identifiable cause of acute liver failure in children.
- Neonatal APAP toxicity, however, is rare.
- We present a case of a premature 5-day-old, 25-week gestation, 720-g neonate with an APAP level of 297 mcg/mL (drawn 3 hours post ingestion of the 3rd supratherapeutic dose) successfully treated with N-acetylcysteine.

Case Report

- A 25-week gestation, 720-g, 5-day-old micro-preemie male was admitted to the Pediatric Intensive Care Unit for a patent ductus arteriosus (PDA).
- APAP was ordered for treating the PDA.
- The prescribed APAP dose was 9.0 mg (12.5 mg/kg) every six hours. Inadvertently the patient was given 90.0 mg every 6 hours 3 times before the miscalculated dose was realized.
- Laboratory findings post supratherapeutic dosing were as follows: APAP level 297 mcg/mL, AST 17 IU/L, ALT <9 IU/L, BUN 49 mg/dL, T Bili 6.3 mg/dL.

<table>
<thead>
<tr>
<th>Pre Treatment</th>
<th>Post Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>APAP level</td>
<td>8.9 mcg/mL</td>
</tr>
<tr>
<td>AST</td>
<td>22 IU/L</td>
</tr>
<tr>
<td>ALT</td>
<td>9 IU/L</td>
</tr>
<tr>
<td>T Bili</td>
<td>6.3 mg/dL</td>
</tr>
<tr>
<td>BUN</td>
<td>36 mg/dL</td>
</tr>
</tbody>
</table>

- The poison center was consulted; the medical toxicologist recommended the standard Intravenous N-acetylcysteine protocol: 150 mg/kg/hr. loading dose, followed by 50 mg/kg/over 4 hrs. followed by 100 mg/kg over 16 hrs. until there was no measurable serum APAP detected, AST/ALT normalized, and the INR was <2.
- The patient received treatment for 45 hours.
- Post treatment lab results were as follows: APAP 8.9 mcg/mL, AST/ALT 22/9, T Bili 5, BUN/Cre 36/0.7, PT 21.4, INR 1.79, and PTT 45.6.

Case Discussion

- Although nonsteroidal anti-inflammatory drugs are the standard therapy for PDA treatment, the physician selected APAP, which is an effective alternative and offers fewer side effects.
- Hepatotoxicity is theoretically possible in micro-preemie neonates after APAP overdose, but there are no guidelines on how to dose NAC.
- The NAC package insert makes recommendations for 10 kg or greater.
- Neonates and infants less than 1 year of age typically have immature enzyme systems, including the sulfation and glucuronidation pathways, and CYP isoforms used in APAP metabolism.
- After APAP overdose young children’s metabolic pathways preferentially select sulfation over glucuronidation, when these pathways are exhausted, APAP metabolism proceeds via CYP 2E1 to the toxic metabolite N-acetyl-p-benzoquinone-imine (NAPQI), responsible for hepatic injury and toxicity.
- APAP toxicity appears to be low in micro-preemies, possibly due to the neonate’s slow oxidative metabolism and rapid glutathione synthesis, both of which lead to a slower production of NAPQI.
- Prompt NAC administration may further decrease hepatotoxicity and liver injury.

Conclusion

- There is limited information on toxicity, biochemical effects, and treatment that occur in micro-preemies after acetaminophen overdose.
- Hepatotoxicity was mitigated in this case with the administration of N-acetylcysteine and possibly the micro-preemie physiological development state.
Coronaviruses are a group of viruses that cause illnesses like the common cold, severe acute respiratory syndrome, Middle East respiratory syndrome, and COVID-19. COVID-19 originated in China in 2019; by March 2020 it was declared a pandemic by the World Health Organization.

The Centers for Disease Control suggest the virus is highly contagious. The virus spread is still under investigation, it is spread mainly from person to person through respiratory droplets and by touching surfaces or objects that are contaminated with the virus.

Auto inoculation can occur by touching these surfaces and then touching the mouth, nose, or eyes. In the United States the virus has infected over 1.5 million people and over 100 thousand have succumbed to the disease.

In an effort to contain the spread of the virus, in March 2020 Federal and State governments issued guidelines to provide flexible and remote work options to employees.

“...A paradigm shift has occurred in the manner in which PC services is delivered”

We performed a telephone survey on participants with remote access.

Questions were asked related to their ability to work successfully at home, productivity, support from leadership, and satisfaction with the efforts to protect their health and safety.

We utilized data from the Toxic Exposure Surveillance System to determine if there was a difference in call volume before and after remote workstations were employed.

There are 50 SPI’s working in the six participating PC’s of which 38 were interested in remote working, satisfied technical requirements, passed the computer set-up test, received institutional authorization, and signed remote agent agreements.

The number of cases managed by the participating poison centers in March and April were 15,922 and 14,827 respectively.

Calls were recorded as required and there were no major technical problems.

From the participating group to date none contracted COVID-19.

Respondents to the survey answered affirmatively that leadership showed concern for their health and safety and expressed a positive remote experience.

The COVID-19 pandemic was declared on March 11th, 2020, and by March 31st the first RA went remote.

Extensive planning and coordination between vendors and stakeholders ensued to develop policies and procedures to include information security, quality improvement standards, and privacy protection of callers.

A paradigm shift has occurred in the manner in which the PC service is delivered. The deployment of RA’s has proven to be an effective and a success in the current crisis while maintaining staff satisfaction and safety.
The Top Ten Medications Most often taken by Preteens to Commit Suicide

Alfredo Gonzalez, DNP, ENP, Darelle Hinson, MSN
South Texas Poison Center, University of Texas Health San Antonio

Objective

- According to the Center for Disease Control and Prevention (CDC) the number of suicides has increased in the United States by 25% over the last two decades.
- Suicide is carried out by different methods which include hanging, firearms, suffocation, and strangulation. Less common methods include railway suicide, jumping from heights, and drug overdose.
- Children attempt suicide daily and every 5 days a child succumbs to suicide. Some drug overdoses exhibit characteristic symptoms/toxidromes.
- Toxidromes can help healthcare professionals identify what the person might have taken, even if the person is a poor historian, uncooperative or incapacitated.
- The primary toxidromes encountered are: anticholinergic: atropine, diphenhydramine, and quetiapine; cholinergic: pesticides; opioids: heroin, hydrocodone; sedative/hypnotics: benzodiazepines and sympathomimetics: amphetamines, caffeine, cocaine.
- The objective of this research is to identify the 10 most common medications used by preteens between the ages of 6 to 12 years of age to commit suicide by drug overdose.

Method

- A retrospective review of the 2019 database from six regional poison centers in the United States to determine the top 10 most commonly used medications by children between the ages of six to twelve years of age who attempted or committed suicide by drug overdose.

Results

- The data from 6 regional Poison Center documented 404 attempts or suicides by drug overdose in 2019.
- The top 10 medications most frequently taken by children attempting suicide, in descending order of frequency are as follows:
  - ibuprofen (20%)
  - acetaminophen adult formulation (16%)
  - atypical antipsychotics (11.6%)
  - sertraline (10.6%)
  - antihistamines alone (9%)
  - diphenhydramine-alone (7.9%)
  - fluoxetine (7.9%)
  - trazodone (5.4%)
  - antibiotics (5.4%)
  - melatonin (5.4%).

Conclusion

- Over 58 percent of the time children in the study took over-the-counter medications to commit suicide.
- These medications are readily available to children but are not innocuous.
- Overdosing on medications such as acetaminophen, antihistamines, and ibuprofen can cause hepatic, renal, neurological, and cardiac toxicity, leading to the child's injury and/or untimely death.
- Prescribed medications such as fluoxetine, sertraline, trazodone, atypical antipsychotics and antibiotics are less accessible but usually remain readily available.
- Medications, like firearms, should be kept secured and be accounted for.
- Medication availability combined with the child's impulsive behavior can contribute to children's increased frequency in suicide by overdose.
Spanish Speaking Staff Increased the Utilization of the Poison Center for Spanish Speaking Calls

Alfredo Gonzalez, DNP, ENP, Darelle Hinson, MSN
South Texas Poison Center, University of Texas Health San Antonio

Objective

- There are over 300 languages spoken in the United States.
- Spanish is the second most spoken language in the United States, and is spoken as the first language in millions of American households.
- As a healthcare resource, the Poison Center provides up-to-date information on toxic exposures.
- The Specialists in Poison Information (CSPI) answers calls from the public, emergency medical services, and healthcare providers.
- Depending on the service population calls from the public may linguistically diverse.
- Studies show language barriers prevent people from seeking medical care, when patients and providers speak the same language patients report less confusion and better health care quality.
- The aim of this study is to determine if the number of Spanish speaking Specialists in Poison Information staffing the poison center makes a difference in the number of Spanish speaking calls managed.

Method cont.

- The study compared two time periods in 2019 where a Poison Center serving a predominantly Hispanic population was staffed with three and five Spanish speaking CSPIs over 157 days.
- Data collected from the surveyed 2019 Poison Center archived cases were reviewed.
- Group A had five Spanish speaking CSPI and managed cases for 157 days from January 1st to June 7th.
- Group B had three Spanish speaking CSPI and managed cases for 185 days from June 8th to December the 10th.
- To have an equal representation of group A and groups B twenty-eight days and the average number of calls managed by group B in that twenty-eight-day time frame was corrected by removing them.

Results

- The average number of Spanish calls managed by the Poison Center under review is 787 per year.
- Group A, managed 291 calls with 5 CSPI's, and group B managed 160 calls with 3 CPSI's during the designated time.
- Each CSPI managed a similar number of cases during the designated study period.
- CSPI's in group A, on the average managed 58 cases in the 157 days, and CSPI's in group B, on the averaged managed 53 cases in 157 days.
- The Poison Center after June 7th only had three Spanish speaking CSPI's. The total number of Spanish language calls managed by the poison center in 2019 was 476.
- There was a 39 percent decrease in Spanish language calls managed by the Poison Center which supports the hypothesis that the more Spanish Speaking CSPI's will manage more Spanish language calls.

Conclusion

- The number of calls managed by CSPI's in group A and B, were similar. More Spanish speaking calls were managed when the Poison Center was staffed with more Spanish speaking CSPI's.
- It would be prudent to assess the community to be served and staff according to the needs of the community. Decreasing language barriers improves access to health information and expands reach for those who may otherwise not be served.
Introduction
We discuss a case of severe vitamin D toxicity and hypercalcemia requiring dialysis following a chronic intentional poisoning of a family (a mother, her 3-year-old son, 4-year-old daughter, her brother, and her parents) with concentrated vitamin D3 oil by the uncle’s estranged wife.

Case
• The 3-year-old and 4-year-old siblings presented to the emergency room with nausea and vomiting. The children were previously treated and discharged a month prior for elevated vitamin D levels and hypercalcemia.

• North Texas Poison Control was contacted for guidance on management, treatment, and assistance in identifying the source.

• Some initial sources of suspicion that were ruled out were rodenticides, genetic issues, environmental causes, food sources, and supplement use.

• During this collaborative effort it was revealed by the children’s uncle that his estranged wife had brought a concentrated vitamin D liquid home from her workplace and siphoned it into another container and gave it to the grandparents under the disguise of a high-grade cooking oil.

• Other family members including the children’s mother, uncle, and grandparents experienced mild symptoms consistent with hypercalcemia and were also treated at local hospitals.

Labs

<table>
<thead>
<tr>
<th>3-year-old male</th>
<th>Units</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vit D 25-hydroxy</td>
<td>ng/mL</td>
</tr>
<tr>
<td></td>
<td>611</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>4-year-old female</th>
</tr>
</thead>
<tbody>
<tr>
<td>Units</td>
</tr>
<tr>
<td>Serum Calcium</td>
</tr>
<tr>
<td>I on Calcium</td>
</tr>
<tr>
<td>Urine Calcium</td>
</tr>
<tr>
<td>Phosphorus</td>
</tr>
<tr>
<td>BUN</td>
</tr>
<tr>
<td>Creatinine</td>
</tr>
<tr>
<td>Urine protein/creatinine</td>
</tr>
<tr>
<td>Vit D 1,25-dihydroxy</td>
</tr>
<tr>
<td>Vit D 25-hydroxy</td>
</tr>
</tbody>
</table>

Discussion
• Vitamin D is a fat soluble vitamin and is available in two forms, D2 (ergocalciferol) and D3 (cholecalciferol).

• Vitamin D is widely available in single dietary supplements, multivitamins, and fortified foods like bread, milk, and cereal.

• Vitamin D is metabolized by vitamin D-25-hydroxylase into 25-hydroxyvitamin D. It acts via specific interactions that occur within the gastrointestinal and skeletal systems to promote calcium absorption and mobilization.

• Most exposures are minor and only cause mild symptoms such as nausea, vomiting, diarrhea, and abdominal discomfort. Severe toxicity is rare and can cause seizures, confusion, renal failure and cardiac dysrhythmias.

• This rare case illustrates the sequelae that can be seen after a chronic exposure to a concentrated vitamin D liquid.

Treatments
• Both children received forced diuresis, calcitonin, pamidronate, and were put on a low sodium diet. It was reported that the 3yo male required emergent dialysis.

Outcome
• Per the limitation of the medical records, it appears each child recovered and had no long-term or permanent effects.

Dean Garibaldi1, Samuel Sproule1, Karen Ryall1
1Rocky Mountain Poison & Drug Center - Denver Health, CO

BACKGROUND

• Kratom is popularly known as a “natural” alternative to prescription opioids and an aid for opioid withdrawal.
• It became readily available in the United States in the early 2010s and reported use and exposures have risen exponentially since 2016 (Figure 1).
• The purpose of this investigation is to compare exposure characteristics of kratom to current pharmaceutical opioid use disorder treatments.

METHODS

• Single product exposures for kratom, buprenorphine and methadone were obtained from National Poison Data System (NPDS) from 2011 to 2019.
• Reason for exposure, level of care, and medical outcome were examined for adult (age ≥12 years) exposures.
• Medical outcomes categorized as ‘clinically significant’ included cases with moderate effect, major effect, or death.
• Descriptive statistics were used to compare exposure characteristics across products.

RESULTS

• 35,865 single product exposures were included in the analysis:
  – Buprenorphine (n=10,653, 57.8%)
  – Methadone (n=9,890, 33.8%)
  – Kratom (n=2,770, 8.4%)
• From 2011 to 2019, kratom exposures increased from 8 to 943 (11,687.5%), buprenorphine exposures increased 16.5%, and methadone exposures decreased 48.5% (Figure 2).
• Kratom exposures experienced the highest proportion of clinically significant outcomes (45.1%). Amongst these, deaths were infrequent across all products (<1.0%).
• Kratom exposures most frequently required evaluation (84.4%) in a healthcare facility (HCF), and were second least likely to involve admission (26.8%; Table 1).
• Intentional Abuse was the most common reason for exposure reported across the products (Table 2).
• Males accounted for 66.3% of kratom exposures, 51.7% of buprenorphine exposures, and 53.4% of methadone exposures.
• Average age was highest in methadone (35.0 years), followed by kratom (32.8 years), and then buprenorphine (19.3 years).

CONCLUSIONS

• Calls to US poison centers from 2011-2019 showed differences in exposure characteristics between kratom, methadone, and buprenorphine.
• Poison center calls for kratom reported higher rates of intentional abuse than for the other drugs studied.
• Understanding the specific reasons for kratom use may provide additional information about its safety relative to other opioid use disorder treatments.
• Though the number of kratom exposures limits the comparison of the 3 products in this abstract, our analysis highlights the need for further research in order to ensure the safety and efficacy of this perceived “natural” opioid treatment alternative.


<table>
<thead>
<tr>
<th></th>
<th>Kratom (n=2,770)</th>
<th>Buprenorphine (n=10,653)</th>
<th>Methadone (n=9,890)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unintentional -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Therapeutic error</td>
<td>28 (1.0%)</td>
<td>1,736 (16.3%)</td>
<td>2,212 (22.4%)</td>
</tr>
<tr>
<td>General</td>
<td>129 (4.7%)</td>
<td>556 (5.2%)</td>
<td>287 (2.9%)</td>
</tr>
<tr>
<td>Misuse</td>
<td>45 (1.6%)</td>
<td>227 (2.1%)</td>
<td>85 (0.9%)</td>
</tr>
<tr>
<td>Other</td>
<td>34 (1.2%)</td>
<td>76 (0.7%)</td>
<td>66 (0.7%)</td>
</tr>
<tr>
<td>Intentional -</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Misuse</td>
<td>319 (11.5%)</td>
<td>1,423 (13.4%)</td>
<td>902 (9.1%)</td>
</tr>
<tr>
<td>Abuse</td>
<td>1,356 (49.0%)</td>
<td>2,812 (26.4%)</td>
<td>2,249 (22.7%)</td>
</tr>
<tr>
<td>Suspected suicide</td>
<td>116 (4.2%)</td>
<td>899 (8.4%)</td>
<td>1,804 (18.2%)</td>
</tr>
<tr>
<td>Other</td>
<td>131 (4.7%)</td>
<td>554 (5.2%)</td>
<td>727 (7.4%)</td>
</tr>
<tr>
<td>Adverse reaction</td>
<td>359 (13.0%)</td>
<td>1,448 (13.6%)</td>
<td>700 (7.1%)</td>
</tr>
<tr>
<td>Other</td>
<td>171 (6.2%)</td>
<td>604 (5.7%)</td>
<td>363 (3.7%)</td>
</tr>
<tr>
<td>Unknown reason</td>
<td>82 (3.0%)</td>
<td>318 (3.0%)</td>
<td>495 (5.0%)</td>
</tr>
</tbody>
</table>

TABLE 1: ADULT (AGES ≥ 12) MEDICAL OUTCOMES AND LEVEL OF HEALTHCARE FACILITY (HCF) CARE BY PRODUCT (2011-2019)

<table>
<thead>
<tr>
<th>Medical Outcome</th>
<th>Kratom (n=2,770)</th>
<th>Buprenorphine (n=10,653)</th>
<th>Methadone (n=9,890)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Clinically Significant Outcomes</td>
<td>1,263 (42.1%)</td>
<td>4,618 (22.3%)</td>
<td>4,644 (38.3%)</td>
</tr>
<tr>
<td>Deaths</td>
<td>8 (0.3%)</td>
<td>9 (0.1%)</td>
<td>54 (0.5%)</td>
</tr>
<tr>
<td>Level of Healthcare Facility (HCF) Care</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>HCF Evaluation</td>
<td>2,062 (84.4%)</td>
<td>4,955 (67.0%)</td>
<td>6,219 (78.4%)</td>
</tr>
<tr>
<td>HCF Admission</td>
<td>741 (26.8%)</td>
<td>2,041 (19.2%)</td>
<td>4,100 (41.5%)</td>
</tr>
</tbody>
</table>

FIGURE 1: COMMON FORMS OF KRATOM

FIGURE 2: ADULT (AGES ≥ 12) KRATOM EXPOSURES OVER TIME

Picture used from SF Examiner website (https://www.sfexaminer.com/marketplace/kratom-near-me/)
N-acetylcysteine as a treatment for amatoxin poisoning: a systematic review

Jiaming Liu, Yang Chen, Yanxia Gao, Joseph Harold Walline, Xin Lu, Shiyuan Yu, Lina Zhao, Zengzheng Ge & Yi Li
INTRODUCTION

Amatoxin poisoning

• Accounts for more than 95% of deaths related to mushroom poisoning
• Non-covalently bind and inhibit RNA polymerase II activity
• No confirmed antidote

N-acetylcysteine (NAC)

• Used to treat mushroom poisoning since the early 1990s
• First case series: a relatively low mortality (8.22%)
• Controversial results were seen in later years
Methods

Eligibility criteria

- Study type: cohort studies, clinical trials or case series with ≥5 patients
- Amatoxin poisoning diagnosed by one of following criteria
  1. Confirmed detectable amanitin in patients’ blood or urine
  2. Confirmed amatoxin-containing mushroom in remnant of food
  3. History of mushroom consumption and typical clinical manifestations
- NAC was used, regardless of dose, dosage form, duration or formula
- Exclusion criteria: non-human studies, non-English or Chinese researches
METHODS

Primary outcome: mortality rate including liver transplant cases (MRLTi)

\[ \text{MRLTi} = \frac{\text{number of deaths} + \text{number of LTs} - \text{number of patients who died after LT}}{\text{number of treated patients}} \]

Secondary outcomes

- Mortality rate excluding liver transplant cases (MRLTe)
- Liver function: transaminase, bilirubin, prothrombin time/International Normalized Ratio (PT/INR), Factor V levels, and occurrence of hepatic encephalopathy
- Renal function: creatinine levels and occurrence of renal insufficiency or renal failure
- Complications in the clinical course
- Adverse reactions of intravenous NAC
RESULTS

Figure 1. Flowchart of the literature search and study selection

- Records identified through database searching (n=213)
- Records identified by hand (n=5)
- Records after duplicates removed (n=206)
- Records excluded based on titles or abstract (n=170)
- Records screened (n=206)
- Full-text articles assessed for eligibility (n=36)
- Full-text articles excluded: Reviews (n=3), Basic science research (n=3), Less than 5 cases (n=11), Studies with the same cases (n=2), Non-English/Chinese language (n=4)
- Included articles (n=13)
RESULTS

Primary outcome

• Overall MRLTi was 11% (57 out of 506 cases), ranged between 2.5% and 44%
• MRLTi in pediatric patients was 14% (1 out of 7 cases)

• MRLTi in studies with mean interval <24 h was 6.3% (9 out of 143 cases)
• MRLTi in studies with mean interval >24 h was 23% (18 out of 80 cases)

• MRLTi of patients receiving combined treatments
  • NAC & silibinin/silymarin: 10.5% (15 out of 143 cases)
  • NAC & penicillin: 7.0% (9 out of 129 cases)
  • NAC & extracorporeal elimination treatments: 7.4% (10 out of 136 cases)
RESULTS

Secondary outcomes
- Overall MRLTe was 7.9% (40 deaths out of 506 cases)
- Overall rate of liver transplantation was 4.3% (22 out of 506 cases)

Liver function
- Transaminase concentrations peaked around 3 days after ingestion
- PT/INR worsened during the first 3-4 days after ingestion before returning to normal 4-7 days after ingestion
- Factor V levels normalized in about 4-5 days after ingestion
RESULTS

Secondary outcomes
  • Renal function
    • Renal failure was reported in 3% (3 out of 101 cases)
    • Acute kidney injury was reported in 19% (5 out of 27 cases)
  • Complications & adverse reactions
    • Gastrointestinal bleeding occurred in 21% (15 out of 71 cases)
    • Anaphylactoid reactions were the principle adverse reaction, occurred in 5% (4 out of 73 cases)
DISCUSSION

MRLTi varies notably between different studies
  • Ranged from 2.5% to 44%
  • Partially due to the heterogeneity of each study’s population, setting, or varying availability of medical resources

MRLTi in newly diagnosed patients is highly likely to be lower than 11%
  • Selection bias
  • Karvellas et al: only studied patients with ALI/ALF with MRLTi of 44%
  • Kieslichova et al: only studied patients admitted to the ICU at a liver transplant center with MRLTi of 30%

An international registry could be of immense value for further analyses
CONCLUSION

• NAC treatment combined with other therapies appears to be beneficial and safe in both adults and children with amatoxin poisoning

• Until further data emerge, it is reasonable to use NAC in addition to other treatments for patients with amatoxin poisoning
Clinical Toxicology

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N-acetylcysteine as a treatment for amatoxin poisoning: a systematic review

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To link to this article: https://doi.org/10.1080/15563650.2020.1784428

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# The Role of the Poison Center and the Use of an Intradepartmental Data Repository During the Novel Coronavirus Outbreak

Lindsey Galusha, PharmD Candidate,1,2 and Nena Bowman, PharmD, DABAT1,2

1Tennessee Poison Center at Vanderbilt University Medical Center, 2Lipscomb University College of Pharmacy

## Background

The novel coronavirus pandemic created an unprecedented public health emergency. Quick and efficient communication of the most current information became a primary goal and necessity for our state. Poison centers historically have been and remain today one of the best methods for critical information dissemination in a public health emergency. The Tennessee Poison Center (TPC) was activated to provide this service for our state on March 5, 2020.

## Methods

**BACKGROUND**

- The TN State Department of Health + TPC ➔ information hotline dedicated to public coronavirus questions
  - Intentionally kept separate from the poison control hotline
  - Call center staff + multitude of rotating volunteers including medical + pharmacy students from 4 institutions
  - Quick access to the most current clinical recommendations + testing triage guidelines + isolation timelines

- Types of caller questions: varied widely as the pandemic reached a variety of communities and created new scenarios

- Coronavirus hotline specialists compiled new and unanswered questions ➔ reported biweekly back to the state health department ➔ clarification & further instruction from TNDOH ➔ TPC continually updating hotline guidance

- Internal Google Site created to use as a centralized data repository for public health information and resources
  - Frequent guideline updates as new information identified
  - TNDOH provided the call center with the answers to frequently asked questions as they became available
  - The internal Google Site was kept up to date in real time as statewide guidelines + CDC recommendations + testing capabilities changed
  - Links to important CDC and TN State Department of Health documents
  - Recommendations by a Poison Information Provider and the Managing Director

## Results

Coronavirus Hotline answered over 16,000 questions in 7 weeks, roughly a third of our typical annual call volume, with consistent, quick, and thorough information. We provided 5,000 hours of service to the TNDOH through staffing of the coronavirus hotline in this timeframe. At this time, the Coronavirus Hotline has answered over 37,000 questions in 5 months for residents of Tennessee.

### Screen shots of some of the site’s features:

<table>
<thead>
<tr>
<th>Home</th>
<th>Updates</th>
<th>New Resources</th>
<th>Resources</th>
<th>cdc.gov</th>
<th>tn.gov</th>
<th>health</th>
<th>Help</th>
</tr>
</thead>
<tbody>
<tr>
<td>TNOphryHealth</td>
<td>@covid19tn</td>
<td>@TNDHAttnHA</td>
<td>@TNDHealth</td>
<td>@TNDOH</td>
<td>@TNCOVID19</td>
<td>@TNDHealth</td>
<td>@TNCOVID19</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Jump To</th>
<th>Other Resources</th>
</tr>
</thead>
<tbody>
<tr>
<td>Page Number Directory</td>
<td>Other Sites</td>
</tr>
</tbody>
</table>

### Resources

- Centers for Disease Control & Prevention
  - CDC: Frequently Asked Questions Updated
  - CDC Global Pandemic, Warnings
  - CDC Health Travel Notices

- The Tennessee Department of Health
  - TCDOH: Informational Hotline Guide
  - TCDOH: Case Investigation Guide
  - TCDOH: Testing for Coronavirus

### Changes in Policy

- Increased call volume
- Increased complexity
- Increased detail of resources

### Conclusions

- Poison Control is in a unique position to assist state & local health departments in a public health crisis
- Challenge: overchanging public health guidance ➔ time sensitive & quality control challenges
- Complications: communication with multiple specialists during masking & physical distancing
- Conclusions: motivated partners + quick centralized resources on Google Sites ➔ overcome communication challenges
- Pros: free & fast setup ➔ efficient to edit & publish, controlled user access, multiple pages, organized layouts
- Additional options to integrate Google Analytics
BACKGROUND

- Lurasidone is a novel antipsychotic approved by the FDA in 2010 to treat schizophrenia and in 2013 to treat bipolar depression.
- Despite being around for almost a full decade, toxicity associated with acute lurasidone has not been well delineated.
- The primary objective of this study is to describe the clinical effects associated with single acute lurasidone ingestions as reported to a single statewide poison center.

METHODS

- In this IRB approved study, all lurasidone ingestions reported to a single state-wide poison center (approximately 35,000 human exposures a year) were prospectively reviewed to increase accuracy of information.
- Cases were collected from March 1, 2017-March 1, 2019.
- Variables recorded:
  - Age
  - Gender
  - Site of treatment
  - Vital signs
  - Physical exam findings
  - Cardiac intervals
  - Electrolytes
- Cases were excluded for
  - Coingestants
  - Subacute or chronic ingestion
  - Lack of follow-up

RESULTS

- In the two-year study period, 47 patients with acute lurasidone ingestion were identified.
- Thirty-one cases were excluded (26 cases excluded for polypharmacy ingestion and 5 cases were excluded for lack of follow-up). See flow diagram to the right.
- Of the 16 cases included in the analysis, 6 were less than 20 years and 10 were adults over 19 years.
- Age ranged from 2 years to 63 years old and 10/16 (62.5%) were female. 9/16 patients were admitted for medical monitoring.
- No patients required ventilator support or advanced airway management. 6/16 patients were noted to be sedated.
- 14/16 patients had vital signs all within normal reference values; the other two patients with abnormal vitals only had tachycardia.
- Hypotension was not seen in any of the cohort.
- No patients had creatinine kinase values > or = 500 units/L.
- One patient reportedly had a seizure prior to arrival in the emergency department that was not witnessed by any health care provider. He did not have any further neurological symptoms after arrival at health care facility.
- No patients had muscle spasms or dystonic reactions.

<table>
<thead>
<tr>
<th>Adolescents (n=6)</th>
<th>Adults (n=10)</th>
<th>Total (n=16)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean Age</td>
<td>10.5 years</td>
<td>36.1 years</td>
</tr>
<tr>
<td>Median Age</td>
<td>11.5 years</td>
<td>32.5 years</td>
</tr>
<tr>
<td>Age Range</td>
<td>2 - 16 years</td>
<td>21 - 63 years</td>
</tr>
<tr>
<td>Female</td>
<td>2/6 (33.33%)</td>
<td>8/10 (80%)</td>
</tr>
<tr>
<td>Male</td>
<td>4/6 (66.66%)</td>
<td>2/10 (20%)</td>
</tr>
</tbody>
</table>

- # Evaluated at HCF: 6
- # Patients admitted to non-ICU: 1
- # Patients admitted to ICU: 0
- # Patients admitted to psychiatry: 1
- Total # patients admitted: 2
- # Patients with symptoms: 5/6 (83.33%), 5/10 (50%), 10/16 (62.5%)

Outcomes:

- None: 1
- Minor: 1
- Moderate: 3
- Major: 1
- Death: 0

CONCLUSION

- In this cohort, acute single ingestion of lurasidone was generally well tolerated.
- The most common symptom appeared to be mild sedation and was seen in less than half of the patients.
- While one patient was recorded as having a seizure, it was not witnessed by any health care provider and none of the other 15 patients had severe neurological effects.
- Except for this patient, no one else was reported as having a major effect.
- No patients developed cardiac arrhythmias, cardiac interval prolongation, or severe respiratory depression.
- While further research is needed, acute single ingestions of lurasidone were generally well tolerated.
# Drug-Induced Hyperthermia: A Tale of Two Temperatures

Emma Furlan,1 Timothy C. Backus,2 Victoria Terentiev,2 Mark K. Su,2 Robert S. Hoffman,3 Mary Ann Howland,2 Silas W. Smith,2 Rana Biary1

1. Division of Medical Toxicology, Ronald O. Perelman Department of Emergency Medicine, NYU Grossman School of Medicine. 2. Ronald O. Perelman Department of Emergency Medicine, NYU Grossman School of Medicine. 3. St. John’s University College of Pharmacy and Health Sciences, Queens, NY

## Background
- Rapidly recognizing and treating hyperthermia is essential to prevent devastating consequences (1, 2).
- We describe two patients with apparent MDMA-associated hyperthermia with significantly different cooling times and outcomes.

## Case 1
- A 27-year-old previously healthy woman was found unresponsive in a nightclub after using “MDMA”.
- Presenting vital signs: BP, 92/58 mmHg; HR, 162 beats/min; RR, 31 breaths/min; T, 107.6°F (rectal); O2 sat, 99% (RA).
- Cooled to 100.4°F within 27 minutes (0.15°C/min) via rapid ice water immersion.
- During cooling she received 3L of intravenous (IV) 0.9% saline and lorazepam 2mg IV.

## Case 2
- A 25-year-old, previously healthy, man was found confused and agitated at a dance club after using “MDMA”.
- Presenting vital signs: BP, 117/68 mmHg; HR, 94 beats/min; RR, 11 breaths/min; T, 102.6°F; O2 sat, 94% (RA).
- Endotracheally intubated with rocuronium 50mg IV and etomidate 20mg IV then sedated with IV midazolam (5mg/hr).

## Table

<table>
<thead>
<tr>
<th>Case</th>
<th>Immediate Ice Immersion</th>
<th>Delayed Ice Immersion</th>
</tr>
</thead>
<tbody>
<tr>
<td>Maximum temperature</td>
<td>107.8°F (42.1°C)</td>
<td>106.4°F (41.3°C)</td>
</tr>
<tr>
<td>Time to ice bath after measured temp &gt; 105°F</td>
<td>&lt;30min</td>
<td>2 hours</td>
</tr>
<tr>
<td>Initial neurological examination</td>
<td>Responsive to pain</td>
<td>Unresponsive to verbal or painful stimuli</td>
</tr>
<tr>
<td>Initial peak lactate (reference range 1.00-1.90 mmol/L)</td>
<td>9.6 (9.6)</td>
<td>16.5 (16.5)</td>
</tr>
<tr>
<td>Initial peak CPK (reference range 35-155 U/L)</td>
<td>1,733 (8,360)</td>
<td>1008 (&gt;78,000)</td>
</tr>
<tr>
<td>Initial peak creatinine (reference range 0.1-1.1 mg/dL)</td>
<td>1.3 (1.3)</td>
<td>21.5 (15.4)</td>
</tr>
<tr>
<td>Initial peak AST (reference range 11-35 IU/L)</td>
<td>65 (612)</td>
<td>54 (3480)</td>
</tr>
<tr>
<td>Initial peak ALT (reference range 25-100 IU/L)</td>
<td>36 (579)</td>
<td>74 (3147)</td>
</tr>
<tr>
<td>Hospital days of ventilator dependence</td>
<td>2 days</td>
<td>49 days</td>
</tr>
<tr>
<td>Hospital days to discharge</td>
<td>3 days</td>
<td>60 days</td>
</tr>
<tr>
<td>Neurological outcome at hospital discharge</td>
<td>At baseline</td>
<td>Unable to ambulate, lower extremity weakness, and dysautonomia</td>
</tr>
</tbody>
</table>

## Discussion
- Two patients with suspected MDMA ingestions were of similar age, without prior medical histories, and presented with similar clinical findings, but had significantly different intervention times to effective cooling.
- Case 1 was cooled within 27 minutes of arrival and discharged 3 days after presentation clinically normal.
- Case 2 had significant delay to effective cooling and spent 60 days in the hospital with likely permanent disability.

## Conclusion
- Drug-induced hyperthermia is a life-threatening emergency that can lead to multisystem organ failure.
- Rapid identification of hyperthermia with evaluation of a core temperature is critical.
- Rapid cooling with ice water immersion can be life-saving and reduce morbidity.
- Delayed cooling with ineffective techniques results in severe complications.

## References:
The Amish Community and Poisonings, are they at Higher Risk of Adverse Outcomes?
Alexandra R. Funk, PharmD, DABAT¹; Andris Grinvalds, PharmD²
Henry A. Spiller, MS, D.ABAT, FAACT¹

¹ Central Ohio Poison Center, at Nationwide Children’s Hospital, Columbus, Ohio; ²Recent Graduate The Ohio State University College of Pharmacy, Columbus, Ohio;

Background

- The Amish lifestyle differs from that of the general non-Amish population due to not using electricity or modern technology
- Amish depend on alternate power sources to survive, notably using fuel such as gasolines or kerosene to run generators and farming equipment, and manufacturing basic household products such as lye soap
- The state of Ohio has more Amish settlements and districts as compared to most other states, and has the second largest population of Amish, trailing Pennsylvania by less than 4%.
- The Amish do not typically own or use personal home or mobile telephones but may have access to a communal phone located somewhere in the district [3].
- Amish are less likely to seek medical attention for any ailment they deem to be minor, choosing instead to use homeopathic and alternative home remedies [4]. Additionally, many Amish do not seek medical attention in health care facilities and from health care workers due to lack of medical insurance [5].
- There is a deficit of studies comparing Amish exposures handled by poison control centers versus the general population.
- Primary objective was to determine if Amish individuals living in Ohio have more severe outcomes and require higher levels of care when compared to the general population served by the Ohio PCCs

Methods

- IRB-exempt retrospective review of Amish exposures reported to Ohio Poison Control Centers between 2000 and 2019
- Audit for accuracy of case coding (outcomes/clinical effects) performed by at least 2 authors for all cases, a third author was utilized as deciding factor if disagreement existed. Case data modified based upon consensus of authors if discrepancies were identified.

Results

- 351 cases identified, 228 meet criteria of Amish patient, 224 Amish exposures
- Amish were 5 times more likely (OR 5.42, 95% CI 4.02 – 7.30; p<0.001) to experience severe outcomes from an exposure, with 26% of Amish exposure calls resulting in severe outcomes vs 6% of non-Amish Ohio cases

Discussion

- The heavy reliance on hydrocarbons for heat, light and cooking provides near ubiquitous availability as well as increased risk of carbon monoxide exposure
- Amish patients experienced severe outcomes at a significantly higher rate than the non-Amish Ohio PCC population. This was particularly troubling in the pediatric population with greater than 10 times the risk of severe injury than the non-Amish pediatric population.
- Limitations: “Amish” needed to be in case notes, limited PCC contact with this patient population

Conclusion

- Amish population is more likely to be exposed to harmful substances, including hydrocarbons and pesticides, and increase risk to developing severe medical outcomes requiring higher levels of care compared to the general population
- Additional outreach to these communities likely to be beneficial

Table 2: Substances involved in Amish exposures

<table>
<thead>
<tr>
<th>Major Category</th>
<th>Total Number of Cases</th>
<th>Severe Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hydrocarbons</td>
<td>89 (39.04%)</td>
<td>24 (40.68%)</td>
</tr>
<tr>
<td>Pharmaceutical</td>
<td>43 (18.86%)</td>
<td>8 (13.56%)</td>
</tr>
<tr>
<td>Carbon Monoxide</td>
<td>14 (6.14%)</td>
<td>10 (16.95%)</td>
</tr>
<tr>
<td>Pesticide</td>
<td>12 (5.26%)</td>
<td>1 (1.69%)</td>
</tr>
<tr>
<td>Miscellaneous</td>
<td>12 (5.26%)</td>
<td>6 (10.17%)</td>
</tr>
<tr>
<td>Alkalis</td>
<td>9 (3.95%)</td>
<td>4 (6.78%)</td>
</tr>
<tr>
<td>Personal Care</td>
<td>9 (3.95%)</td>
<td>1 (1.69%)</td>
</tr>
<tr>
<td>Foreign Body</td>
<td>9 (3.95%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>Cleaner</td>
<td>8 (3.51%)</td>
<td>1 (1.69%)</td>
</tr>
<tr>
<td>Essential Oil</td>
<td>6 (2.63%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>Plant</td>
<td>4 (1.75%)</td>
<td>1 (1.69%)</td>
</tr>
<tr>
<td>Plant / Mushroom</td>
<td>7 (3.07%)</td>
<td>3 (5.08%)</td>
</tr>
<tr>
<td>Information Call</td>
<td>4 (1.75%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>Food</td>
<td>2 (0.88%)</td>
<td>0 (0.00%)</td>
</tr>
<tr>
<td>Total</td>
<td>228 (100%)</td>
<td>59 (100%)</td>
</tr>
</tbody>
</table>
Better Evaluating of EVALI: A Scoping Review of the Inhaled Pulmonary Effects of Vitamin E Analogues or Pyrolyzed Acetate

Ryan Feldman¹,², Matthew Stanton¹,²
¹The Wisconsin Poison Center, ²Froedtert & The Medical College of Wisconsin,

**Background**

Vitamin E Acetate (VEA) has been associated with E-cigarette and Vaping Associated Lung Injury (EVALI).

Theoretical Toxic Mechanisms
- Vitamin E surfactant damage
- Vitamin E inflammatory macrophage recruitment
- Pyrolysis of acetate to pulmonary irritant ketene

What experimental data supports these toxicities?

**Methods**

- PRISMA compliant scoping review
- Ovid MEDLINE® and Epub Ahead of Print, In-Process & Other Non-Indexed Citations
- Daily and Versions* 1946 to February 26, 2020
- Dual article review
- Independent data abstraction

**Results**

- Database searched for human or animal studies: Pulmonary Vitamin E OR Pyrolyzed acetate AND Pulmonary tissue assessment
- 784 articles identified
- 187 toxicology + lung
- 14 inhalational Vitamin E
- 0 Pyrolyzed Acetate

9/14 Studies-Vitamin E + Toxin
2/14 Studies VEA + Toxin
1/14 Studies VEA Alone
2/14 Studies VEA Alone

**Discussion**

- Vitamin E protective against toxicants
- VEA no positive or negative effect with toxin
- VEA alone increased markers of lung injury vs control
- Large heterogeneity in outcomes collected, animals, and how exposure occurred
- No studies of pyrolyzed acetate

**Next Steps**

- Standardization of outcomes such as lung weight or pathologic analysis
- Evaluation of Vitamin E and VEA without co-exposed toxicants
- Trials evaluating VEA administered via pyrolysis
Outcomes of hyperbaric oxygen treatment following hydrogen peroxide ingestion: a systematic review

Megan Fee1, Katherine G. Akers, PhD2, Benjamin Hatten, MD, MPH2, Andrew King, MD1
1Wayne State University School of Medicine, 2Section of Medical Toxicology, Department of Emergency Medicine, University of Colorado-School of Medicine

BACKGROUND

- Hydrogen peroxide (H2O2) can cause significant morbidity and mortality due to oxygen emboli.
- Emboli can result in ischemia to vital organs and cause sudden cardiovascular collapse due to obstructive shock.
- Hyperbaric oxygen therapy (HBOT) is recommended for treatment of “left-sided embolic phenomena” (stroke, seizure, myocardial infarction (MI)) from H2O2 exposures.
- Clinical efficacy of HBOT in this setting remains largely undocumented.

OBJECTIVES

- To evaluate effect of hyperbaric treatment for left-sided embolic symptoms after H2O2 ingestion on outcomes using cases described in the literature and reported to US Poison Centers (USPCs)

METHODS

- PubMed, EMBASE, CINAHL Complete, Web of Science, Scopus, and Google Scholar searched for “hydrogen peroxide”, “H2O2”, “emboli”, and “embolism”
- Cases were excluded if they were animal studies, commentaries, opinion pieces, or letters to the editor that did not include specific cases. Cases published in languages authors could not translate using online tools were also excluded.
- Abstracted data from literature cases included: age, sex, volume and concentration of exposure, timing of embolic symptom onset, and type(s) of embolic event.
- Abstracted data was combined with embolic cases from Hatten et al 2017 for analysis (see references)
- Stroke, seizures, MI, hemodynamic instability, and gas emboli in either ventricle, pulmonary arteries or coronary arteries were defined as clinical effects of interest (CEOIs).
- Timing and outcomes of HBOT were recorded and analyzed using Chi-Squared and Mann-Whitney U

RESULTS

- 126 cases were included for analysis: 85 from literature search and 41 from prior USPC reports. Of those, 79 patients had at least one CEOI identified

![Flowchart of cases with CEOI classification based on treatment and outcome](image)

![Outcomes based on treatment management](image)

- Although the portion of patients with full recovery that received HBOT was greater, results were not statistically significant: Chi-squared 1.4; p = 0.23
- Similarly, mean time from CEOI onset to HBO treatment in full recovery group was 9 h and mean time for partial recovery/death group was 18.2 h. Comparison was not significant: two-sided Mann-Whitney U; p = 0.40

DISCUSSION

- Retrospective data from a systematic literature search and cases reported to USPCs were assessed for any correlation between hyperbaric treatment and outcome
- Additionally, we assessed for any effect of time between groups that had full recovery and those that had residual deficits or death
- Although findings were not significant, there appears to be a trend that favors not only treatment, but earlier treatment, which is consistent with pathobiology and treatment rationale
- Data is subject to both publication bias and biases inherent in poison center data acquisition. Further, disease recognition and access to hyperbaric therapy likely affected care
- Study is likely underpowered to show true effect of HBOT and should not dissuade use of HBOT in appropriate cases
- Prospective cluster trial of USPCs after concentrated H2O2 ingestion (i.e. USPCs recommend immediate HBOT, observation then HBOT if embolic event occurs, or no HBOT) is suggested.

CONCLUSION

- While retrospective analysis of this data set did not detect a statistically significant effect of HBOT or its timing on outcomes, early HBOT is likely beneficial for patients presenting with CEOI after H2O2 ingestion
- Prospective study is required to show true effect of hyperbaric therapy

LITERATURE CITED

A 48-year-old male presented to the ED after ingesting 90 tablets of 300 mg extended-release bupropion (2700 mg total) in a suicide attempt. The patient called emergency medical services (EMS) approximately 10 minutes after ingestion complaining of chest discomfort. On arrival to the emergency department (ED) the patient had altered mental status and required intubation secondary to refractory seizures. He was given activated charcoal, polyethylene glycol and started on a propofol infusion as well as norepinephrine due to fluid refractory hypotension. Patient was transferred to tertiary care facility. On arrival to the tertiary care facility he had no brainstem reflexes. Pupils were 6 mm and non-reactive. Patient exhibited reflexes in upper extremities but had no response to noxious stimuli. EEG demonstrated continuing seizure activity that responded to lorazepam and continued propofol. The patient also exhibited intermittent junctional rhythm with a QTc of 611 ms. Comprehensive blood drug screen was positive for bupropion and did not detect any other substances.

DISCUSSION

- A monocyclic aminoketone, bupropion shares structural similarity to cathinone, a naturally occurring amphetamine analogue found in the leaves of Catha edulis, the plant from which illicit synthetic cathinones (“bath salts”) are derived (Figure).
- Although the exact mechanisms are not entirely understood, the toxic effects of the drug include status epilepticus, cardio toxicity, and pseudo brain death.
- Cardiotoxicity is rare, but both QTc prolongation and QRS widening have been reported with the potential to progress to ventricular arrhythmias and cardiac arrest.
- Seizures are dose-dependent and are very common in overdose.
- Discussion between some toxicologists note ingestions greater than 2.5-3.0g all but guarantee seizure activity will occur.
- Subclinical seizures contributing to neuronal damage should be recognized early via emergent EEG and treated aggressively.
- For seizures, treatment with benzodiazepines is indicated. If necessary, barbiturates and propofol may be considered for refractory seizures.
- Because bupropion can mimic brain death, extreme caution should be exercised in giving an early prognosis regarding neurologic outcome.
- With a half-life that varies between 20 to 37 hours, near complete clearance should be obtained prior to reliable neurologic evaluation.
- In both this instance and other reports, patients have gone from a complete lack of brainstem reflexes to full neurologic recovery.
- In one similar case, a male was formally declared brain dead only to regain brainstem function prior to organ harvest; he ultimately made a full neurologic recovery without sequelae.

CASE PRESENTATION

- A 48-year-old male presented to the ED after ingesting 90 tablets of 300 mg extended-release bupropion (2700 mg total) in a suicide attempt.
- The patient called emergency medical services (EMS) approximately 10 minutes after ingestion complaining of chest discomfort.
- On arrival to the emergency department (ED) the patient had altered mental status and required intubation secondary to refractory seizures.
- He was given activated charcoal, polyethylene glycol and started on a propofol infusion as well as norepinephrine due to fluid refractory hypotension.
- Patient was transferred to tertiary care facility.
- On arrival to the tertiary care facility he had no brainstem reflexes. Pupils were 6 mm and non-reactive. Patient exhibited reflexes in upper extremities but had no response to noxious stimuli. EEG demonstrated continuing seizure activity that responded to lorazepam and continued propofol. The patient also exhibited intermittent junctional rhythm with a QTc of 611 ms.
- Comprehensive blood drug screen was positive for bupropion and did not detect any other substances.

INTERVENTION

- Patient was admitted to the hospital for monitoring and supportive care.
- Approximately 36 hours after ingestion, the neurological exam showed intact brainstem reflexes. Neurologic function gradually improved throughout duration of stay.
- On discharge he was able to stand and take steps with assistance. He was transferred to a rehabilitation facility.

CONCLUSIONS

- Bupropion is an atypical antidepressant that is increasing in popularity.
- With a particularly dangerous overdose profile, understanding the presentation and stabilization of bupropion toxicity is critical for clinicians treating these types of patients.
- This case describes an intentional overdose of approximately 27 grams of bupropion without concomitant drug ingestion resulting in status epilepticus, QTc prolongation, and the appearance of brainstem death.
- This patient ultimately made a full recovery emphasizing the necessity of educating providers to keep neurologic prognoses extremely guarded.
E-cigarette (e.g. Juul) market expansion was associated with a significant increase in nicotine poisonings among young children.
Clinical outcomes of “massive” APAP overdose treated with standard-dose N-acetylcysteine

John Downs MD\(^1\); Kirk Cumpston DO\(^1\); Emily Kershner MD\(^1\); Michelle Troendle MD\(^1\); SR Rose PharmD\(^1\); Brandon Wills DO\(^1\)

\(^1\)Department of Emergency Medicine, Virginia Commonwealth University Health System, Richmond, VA

### Background

- Patients presenting after a single acute overdose of acetaminophen (APAP) have traditionally received prophylactic treatment with N-acetylcysteine (NAC) with standard dosing of 300mg/kg over 21 hours.
- Recently, some authors suggest larger NAC doses may improve outcomes following massive (>30-40 grams) APAP OD.
- Primary study aim: evaluate the clinical outcome for patients meeting massive APAP overdose criteria treated with a standard intravenous NAC dosing of 300mg/kg in the first 21 hours.
- Secondary study aim: determine incidence of acute liver injury (AST/ALT > 150 U/L, but < 1000 U/L) and hepatotoxicity (AST/ALT > 1000 U/L) among these patients.

### Methods

- Single poison center retrospective cohort conducted by chart review 1 Jan 2010 to 31 Dec 2019
- Cases of massive APAP overdose defined by an [APAP] greater than 300, 450, or 600 mcg/mL at 4 hours post-ingestion.
- Exclusion criteria: unknown time and/or >27 hours post-ingestion, NAC dosing greater than 300mg/kg in 21 hours, or oral NAC utilized
- Standard univariate statistical analysis was conducted. Multivariate logistic model was utilized to calculate adjusted odds ratios for risk of hepatotoxicity

### Results

- 1425 cases of APAP overdose were initially reviewed.
- 105 cases included for massive APAP overdose.
- No deaths or liver transplants were noted among cases.
- 6 cases (5.7%) of acute liver injury
- 26 cases (24.7%) hepatotoxicity

<table>
<thead>
<tr>
<th></th>
<th>Time to NAC &lt; 8 hours</th>
<th>Time to NAC &gt; 8 hours</th>
<th>p value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female, n (%)</td>
<td>n=45 (42.8%)</td>
<td>n=60 (57.1%)</td>
<td>0.335</td>
</tr>
<tr>
<td>Mean Age (95% CI)</td>
<td>28.9 (24.4-33.4)</td>
<td>27.8 (24.0-31.6)</td>
<td>0.708</td>
</tr>
<tr>
<td>AST/ALT &gt;1000 U/L, n (%)</td>
<td>4 (8.9)</td>
<td>22 (36.0)</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>Mean NAC Duration, hours</td>
<td>34.4</td>
<td>50.6</td>
<td>0.032</td>
</tr>
<tr>
<td>Activated Charcoal, n (%)</td>
<td>16 (35.5%)</td>
<td>6 (10.0)</td>
<td>0.005</td>
</tr>
<tr>
<td>Nomogram Line Crossed, n (%)</td>
<td>300 (82.2)</td>
<td>26 (43.3)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>450 (11.1)</td>
<td>10 (16.7)</td>
<td></td>
</tr>
<tr>
<td></td>
<td>600 (3.7)</td>
<td>24 (40.0)</td>
<td></td>
</tr>
</tbody>
</table>

### Discussion

- Standard NAC dosing was adequate therapy even in massive APAP overdose
- Hepatotoxicity in massive APAP overdose is more likely due to treatment delay
- Consistent with historical studies, 5-10% may develop hepatotoxicity despite NAC within 8 hours, but ultimately recover
- Late presenters tended toward larger ingestions which further contributes to hepatotoxicity
- Study limitations include single center data, errors in poison center data collection

### Conclusion

Standard dose NAC within 8 hours of ingestion will adequately prevent hepatotoxicity in the majority of massive APAP overdoses.

### References


Negligible Nux Vomica: Do homeopathic remedies contain any strychnine?

John Downs MD\(^1\); Carl Wolf PhD\(^2\); Grace Williams PhD\(^2\); Kirk Cumpston DO\(^1\); Brandon Wills DO\(^1\);

\(^1\)Department of Emergency Medicine, Virginia Commonwealth University Health System
\(^2\)Department of Pathology, Virginia Commonwealth University Health System, Richmond, VA

**Background**
- The St. Ignatius bean (Strychnos ignatii) and homeopathic “Nux Vomica” extract have been advocated in alternative medicine circles as treatments for gastrointestinal distress.

**Study Aims:**
1) Analyze commercially available Nux Vomica products and a sample of purchased St. Ignatius beans to determine their strychnine and brucine content
2) Determine if overdose of these products could be expected to result in clinically significant toxicity.

**Methods**
- Ultra-performance liquid chromatography tandem mass spectrometry (UPLC-MS/MS)
- Detection limits 0.0001 mcg/g or mcg/mL
- “Nux Vomica” products as shown (right)
- St. Ignatius beans analyzed after a 1 hour steep in either hot water (whole bean), or ethanol (macerated bean)

**Results**
- The analyzed “Nux Vomica” products → No detectable strychnine or brucine
- Hot water steeped whole St. Ignatius bean → 0.55 mcg strychnine → No brucine detected
- Ethanol steeped macerated St. Ignatius bean → 0.56 mcg strychnine → No brucine detected
- 30-45 mg of strychnine required for toxicity
- Average St. Ignatius bean ~ 3 grams in weight

**Discussion**
- Analyzed “Nux Vomica” products will not lead to human toxicity
- Analyzed St. Ignatius Beans would require massive numbers to produce human toxicity
- Limited by possible variations in “Nux Vomica” product formulations, variations in plant alkaloid concentrations, and single lab analysis

**Conclusion**
Quantifiable amounts of strychnine in homeopathic “Nux Vomica” products or St. Ignatius beans are not likely to result in clinically significant strychnine toxicity.

**References**
# Hypercalcemia and Pseudohypercalcemia from Strontium Supplementation

## Case Report

- **75 y/o F presented to the ED with weakness**
- **Serial Ca 14.9 mg/dL (normal ~8-10)**
- **Ionized Ca 7.8 mg/dL (normal ~4-5)**
- Pt reported taking Strontium (Sr) for “bone health”
- We questioned whether Sr could cause either elevated calcium or interfere with the calcium assay

## Laboratory Interference Studies

- **Plasma or whole blood samples were fortified with 0.1, 0.5, 1.0, 2.5, and 5.0 mg/dl strontium**
- **Strontium positively interfered with plasma calcium measurement using the Abbott arsenazo method (figure A)**
- Sr was spiked into pooled whole blood specimens at 5.0 mg/dl and calcium was measured on a Nova blood gas instrument and GEM5000 point-of-care instrument (figure B)
- Clinically significant increases in ionized and plasma calcium were noted at Sr concentrations at 5.0 mg/dl (figure A and B)
- **There was negligible Sr interference with the NOVA ionized calcium assay**

## Background

- Strontium (Sr) is a chemical element and alkaline earth metal
- It has been purported to improve bone density
- Sr has similar properties as calcium which could impact bone physiology
- We present a case of hypercalcemia associated with Sr supplementation
- Sr interference with the calcium laboratory assay was confirmed

## Discussion

- Strontium positively interferes with calcium assays
- Interference variable between analysis methods
- Strontium may also impact calcium handling and could potentially cause hypercalcemia
- Patients taking strontium containing supplements are possibly at risk for both hypercalcemia and pseudohypercalcemia
- Significant interference observed was found using Abbott Architect arsenazo dye method and GEM5000 point-of-care ISE method
- Significantly less interference observed using the NOVA ionized calcium assay via ISE

## Conclusion

- Supplementation with strontium can result in an inaccurate interpretation of serum calcium
- Interference with the calcium assay contributes to this finding however, Sr-mediated alterations in calcium homeostasis are not well understood and require additional study
- Clinically suspect calcium measurements may be tested by an alternate method using blood gas instrument

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**Figure:** A) Increasing strontium concentration demonstrates increasing interference in arsenazo-dye-mediated calcium assay on the Abbott Architect. B) Comparison of strontium (5.0mg/dL) interference in three calcium assays
Herbal antidiabetic products are popular in Vietnam. Many cases have presented to hospitals with severe lactic acidosis, shock and were ultimately fatal. We reviewed the clinical findings of these patients for factors that contributed to their illness and death, and analyzed the ingredients contained in these herbal products sold for diabetic treatment.

Methods
This was a single-center, retrospective, observational case series. Data were collected on all cases who presented with severe lactic acidosis after use of traditional herbal anti-diabetic pills, over the two-year time period 2018 – 2019. Past medical histories and clinical findings were reviewed. Samples of the herbal anti-diabetic products, and patient blood and urine were analyzed.

Results
A total of 18 cases of severe lactic acidosis with use of herbal antidiabetic pills were reviewed. These patients had a diagnosis of diabetes for an average of 9 years (9.4 +/-4.6 years). Use of these herbals for blood glucose control ranged from one month to 8 years; approximately 50% of these patients consumed these products over a year's time. Only two cases had combined herbal products and metformin 500 mg. A total mean of herbal pills consumed were 9 (SD ± 8); patients commonly took combinations of two different colored tablets.

Major manifestations included gastrointestinal disorders, severe metabolic acidosis (pH = 6.85 ± 0.22, HCO3- = 4.4 ± 2.6), with multi-organ failure and shock on admission. Hyperlactatemia was present in all cases (195 ± 74 mg/dL). For lactate removal and acidosis correction, IHD/CRRT was performed, ranging from 2 hours to 72 hours depending on the severity of lactic acidosis and patient need. Mortality rate was 33.3% and all patients became hypoglycemic, either at initial presentation or during treatment.

Conclusions
Biguanides are an effective treatment for diabetes and were added to traditional herbal pills sold and used for blood glucose control. Many users of these products are doing so because of cost and perception of the safety of natural remedies. Biguanide poisoning may still occur even in patients without renal impairment.
Fentanyl-contaminated Cocaine Poisonings: A Case Series with Laboratory Confirmation

Philip DiSalvo,1 Gail Cooper,2 Jessica Tsao,1 Michelle Romeo,1 Larissa K Laskowski,1 Gregg Chesney,1 Mark K Su1,3
1. Division of Medical Toxicology, Ronald O. Perelman Department of Emergency Medicine, NYU Grossman School of Medicine, 2. Office of Chief Medical Examiner, New York City, 3. New York City Poison Control Center, Department of Health and Mental Hygiene

Case Summary
Within a span of three hours in November, 2019, nine patients from five discrete locations were brought to two of our affiliated urban academic emergency departments (EDs). None had a history of opioid use disorder. All patients endorsed insufflating cocaine prior to ED presentation. Shortly after insufflation, all patients developed lightheadedness, and seven patients lost consciousness. Emergency Medical Services found the patients to have varying degrees of respiratory depression. Seven required naloxone en route to the hospital. All nine patients reported nausea and/or emesis which resolved with symptomatic treatment, and all were discharged home from the ED.

Blood samples were obtained from eight patients, and urine samples were obtained from six. All patients who provided urine specimens tested positive for cocaine metabolites and had quantifiable fentanyl concentrations, as well as several detectable fentanyl derivatives, analogues, and synthetic opioid manufacturing intermediates, shown in the table.

Discussion
The geographic and temporal proximity of our patients’ presentations, combined with the overlap in fentanyl precursors and analogues found on laboratory testing, strongly suggests a common source, though sample product was not available for confirmation from any of the patients. Interpretation of this data is subject to a number of limitations, including variations in time between exposure and lab collection limiting interpatient comparability.

Fentanyl-contamination of illicit drugs remains a public health concern that does not appear to be restricted to heroin. Increasing prevalence implies that providers should elevate their level of suspicion for concomitant fentanyl exposure even in cases of non-opioid drug intoxication. Responsive public health apparatuses need to prepare for future fentanyl-contamination outbreaks.
How Quickly Do Lithium Concentrations Fall in Chronic Overdoses: A Validation of a Proposed Lithium Nomogram

Philip DiSalvo,1 Emma Furlano,1 Mark K Su,1,2 Sophie Gosselin,3 Robert S. Hoffman1

1. Division of Medical Toxicology, Ronald O. Perelman Department of Emergency Medicine, NYU Grossman School of Medicine, 2. New York City Poison Control Center, Department of Health and Mental Hygiene, New York, NY, 3. Centre Intégré de Santé et de Services Sociaux (CISSS) Montérégie-Centre Emergency Department, Hôpital Charles-Lemoyne, Greenfield Park, QC

Background

The Extracorporeal TReatments in Poisoning (EXTRIP) workgroup “suggests” hemodialysis for patients with lithium toxicity if the concentration [Li+] is expected to remain >1 mEq/L after 36 hours of treatment. In their recent study involving 250 patients with chronic lithium toxicity, Buckley et al derived a nomogram to predict patients whose [Li+] would remain above this concentration after 36h. We performed an external validation of that new lithium toxicity nomogram.

Methods

We performed two Structured Query Language searches of our Poison Center Database: 1) all lithium poisoned patients from 1/1/2000-present for whom hemodialysis was either recommended or performed; 2) all lithium poisoned patients from 1/1/2019-present not included in search 1. The first search maximized inclusion of the sickest patients. Patients were reviewed by two authors and clinical information was extracted using a predetermined form. Inclusion criteria were: chronic lithium toxicity, peak [Li+] ≥1.2 mEq/L, initial creatinine recorded, timed [Li+] available to assess the 36 hour [Li+], and hemodialysis not performed. At least one documented [Li+] <1 mEq/L before 36 hours or a [Li+] ≥1 mEq/L after 36 hours was needed for analysis. The predicted 36 hour [Li+] was calculated using Buckley’s method without adjustment of eGFR for race, because race is not documented in our database. Sensitivity, specificity, positive and negative predictive values (PPV, NPV), and accuracy were calculated.

Discussion

Predicting patients with chronic lithium poisoning at risk of failing conservative therapy based on their initial [Li+] and serum creatinine is of benefit to prompt consideration of earlier hemodialysis. Likewise, identifying patients likely to eliminate lithium in less than 36h would obviate the need for hemodialysis and related interhospital transfers. Based on our preliminary findings, the low PPV of the Buckley’s nomogram prevents its use to select patients for hemodialysis, but the strong NPV might help identify patients for whom hemodialysis is likely unnecessary. Prospective validation in a larger cohort is required and underway.
Comparison of the Extracorporeal Treatments in Poisoning (EXTRIP) and Paris Criteria for Lithium Poisoned Patients

Philip DiSalvo,¹ Emma Furlano,¹ Mark K Su,¹,² Sophie Gosselin,³ Robert S. Hoffman¹

¹. Division of Medical Toxicology, Ronald O. Perelman Department of Emergency Medicine, NYU Grossman School of Medicine, 2. New York City Poison Control Center, Department of Health and Mental Hygiene, New York, NY, 3. Centre Intégré de Santé et de Services Sociaux (CISSS) Montérégie-Centre Emergency Department, Hôpital Charles-Lemoyne, Greenfield Park, QC

Background & Methods

The Extracorporeal Treatments in Poisoning (EXTRIP) workgroup made “recommendations” and “suggestions” for hemodialysis (HD) in lithium poisoning based on consensus and low-level evidence in the published data available. Subsequently, in a single-center retrospective analysis, Vodovar et al proposed their criteria (Paris), asserting it could reduce hemodialysis use without worsening neurological outcomes. We reviewed all Li toxicity cases in our poison center database from 1/1/2000 to 5/31/2020 in which HD was either recommended or performed. Cases with sufficient data to assess Paris and EXTRIP criteria were compared with regard to neurological outcome.

Results & Discussion

We identified 219 patients in our database who met inclusion criteria and had sufficient data (table). When both Paris and EXTRIP agreed that hemodialysis was indicated, 50/57 (88%) of patients who received hemodialysis improved, as did all 3 who did not receive hemodialysis. When both Paris and EXTRIP agreed that hemodialysis was not indicated, the outcome without hemodialysis was universally favorable. In only 8 patients, Paris criteria indicated hemodialysis while EXTRIP did not. All patients received hemodialysis and improved. However, among the 86 patients for whom hemodialysis was indicated by either EXTRIP criteria but not by Paris criteria, 4/19 (21%) patients who did not receive hemodialysis clinically worsened (p=0.02; OR=8.7, 95%CI=1.5-51.8), one of whom died. When the EXTRIP and Paris criteria are both in favor of hemodialysis, dialyzed patients do well. When the two are against hemodialysis, non-dialyzed patients do well. When the criteria are discordant, EXTRIP criteria outperforms the Paris criteria at identifying potentially ill patients who might benefit from hemodialysis.

<table>
<thead>
<tr>
<th>Hemodialysis</th>
<th>Done</th>
<th>Not Done</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Clinically Improved</td>
<td>No change</td>
</tr>
<tr>
<td>EXTRIP Criteria Recommend or Suggest</td>
<td>FOR HD</td>
<td>135</td>
</tr>
<tr>
<td></td>
<td>AGAINST HD</td>
<td>31</td>
</tr>
<tr>
<td>PARIS</td>
<td>FOR HD</td>
<td>55</td>
</tr>
<tr>
<td></td>
<td>AGAINST HD</td>
<td>75</td>
</tr>
</tbody>
</table>

Any EXTRIP + PARIS

| BOTH FOR HD | 50 | 4 | 3 (3) | 3 | 2 | 0 | ND | ND |
| BOTH AGAINST HD | 14 | 2 | 0 | 5 | 0 | 0 | ND | ND |

Any EXTRIP FOR HD + PARIS AGAINST HD | 61 | 4 | 2 | 13 | 2 | 4(1) | 0.019 | 8.7 (1.5-51.8) |

Any EXTRIP AGAINST HD + PARIS FOR HD | 5 | 3 | 0 | 0 | 0 | 0 | ND | ND |

ND = no comparison done because of empty cells, HD = hemodialysis
The Toxikon consortium

A Valuable Toxicology Education: Emergency Medicine Residents' Experiences at a Regional Poison Center

Carol DesLauriers\(^1\)\(^2\); Michele Zell-Kanter\(^2\); Sean Bryant\(^1\)\(^2\)

Background
An accredited medical toxicology fellowship and clinical consulting service in conjunction with its affiliate Regional Poison Center, the Illinois Poison Center (IPC), offers a month-long toxicology rotation for emergency medicine (EM) residents. This rotation includes didactic case conferences, journal club, and backup call with medical toxicologists. Additionally, residents spend 20 hours over one week onsite in the IPC precepted by a clinical pharmacist who is a Certified Specialist in Poison Information. They perform health care facility follow-up via telephone.

Methods
All EM residents who completed the IPC rotation were sent a survey link via email which asked 3 questions regarding the rotation (see results). Each question had 5 answer choices: Strongly Agree, Agree, Neutral, Disagree, Strongly Disagree. Survey responses were anonymous. The study period was 16 months.

Conclusion
The majority of EM residents who completed an experiential IPC rotation felt the experience was educational and valuable. Future study may include IPC staff perceptions of training and educating rotating residents, as well as the benefits and quality of their health care facility follow-up calls.

Results
103 residents completed the experiential rotation during the study and 52 surveys were returned (50% response rate). Questions were as follows.

A: After the rotation were you more aware of the scope of IPC services, the variety of cases managed, and the expertise of IPC staff?

B: Did you gain additional knowledge regarding the clinical course and treatment of various overdose and poisoning exposures?

C: Did you feel the IPC experience was educational and valuable?

<table>
<thead>
<tr>
<th>Question</th>
<th>Strongly Agree</th>
<th>Agree</th>
<th>Neutral</th>
<th>Disagree</th>
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<tr>
<td>A</td>
<td>30</td>
<td>50</td>
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<td>C</td>
<td>20</td>
<td>50</td>
<td>30</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Blue = Strongly Agree
Orange = Agree
Unintentional Pediatric Marijuana Exposures Reported to the Rocky Mountain Poison Center

Delva-Clark Heather1, Wang George Sam2, Ryall Karen A1, Reynolds Kate M1, Iwanicki Janetta L1, Hoyte Chris1
1. Rocky Mountain Poison & Drug Safety – Denver Health, Denver, CO 2.University of Colorado Anschutz Medical Campus – Children’s Hospital Colorado, Aurora, CO

INTRODUCTION

• Since Colorado initiated the sale of recreational marijuana in retail establishments in 2014, unintentional pediatric exposures to marijuana products have increased.
• Colorado implemented interventions (e.g., child resistant packaging; opaque packaging; dose limitations) to prevent/reduce toxicity from unintentional pediatric exposures.
• Impact of these public health interventions is unclear.
• The objective of this analysis is to describe annual trends and exposure characteristics of unintentional pediatric marijuana exposures reported to Rocky Mountain Poison Center (RMPC) from 2010 through 2019.

METHODS

• National Poison Data System queried for exposures involving ≥1 generic marijuana code
• Inclusion criteria:
  – Unintentional general exposure
  – Child <6 years old
  – Exposure date of 01January2010 to 31December2019
  – Exposure reported to RMPC
• Exclusion Criteria:
  – Confirmed non-exposure
  – Exposure to a synthetic cannabinoid product only or a cannabidiol product only
  – Products were categorized by type:
    – Capsule/pill, edible, pharmaceutical preparation, plant, topical preparation, vaping product, other/unknown
  – Descriptive statistics were used to evaluate medical outcome, level of care, and product type over time.

RESULTS

• 561 unintentional pediatric exposures to marijuana products reported to RMPC from 2010-2019 (Figure 1).
• Treated/evaluated at a healthcare facility without admission was the most common level of care received (Table).
  – Exposures resulting in HCF admission fluctuated from 2014 through 2019 (range: 20.2% to 29.3%).
  – Overall, 64.3% of exposures resulted in at least a minor effect (Figure 2).
  – Minor effect (48.7%); moderate effect (14.4%); major effect (1.1%); death (0.2%)
• Reported exposures to edible products (Figure 3):
  – No exposures from 2010-2012.
  – Increased from 2013 (27.8%) to 2014 (53.3%), decreased in 2015 (44.0%), and remained consistent from 2016 (64.4%) to 2019 (59.4%).
  – Decreased from 2013 (66.7%) to 2019 (17.5%).

Table. Level of Care for Pediatric Exposures to Marijuana Products Reported to RMPC (2010-2019)

<table>
<thead>
<tr>
<th>Year</th>
<th>Admitted to Critical Care Unit</th>
<th>Admitted to Non-Critical Care Unit</th>
<th>Treated/Evaluated without Admission</th>
<th>Admitted to Psychiatric Facility</th>
<th>Patient Lost to Follow-Up</th>
<th>Did Not Arrive at Healthcare Facility</th>
<th>Left Against Medical Advice</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0.0%</td>
<td>100.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>10.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2011</td>
<td>1.0%</td>
<td>99.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>9.1%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2012</td>
<td>1.0%</td>
<td>99.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>9.1%</td>
<td>0.0%</td>
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<tr>
<td>2013</td>
<td>1.0%</td>
<td>99.0%</td>
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</tr>
<tr>
<td>2014</td>
<td>2.0%</td>
<td>98.0%</td>
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<td>9.0%</td>
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</tr>
<tr>
<td>2015</td>
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<td>97.0%</td>
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<td>9.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2016</td>
<td>4.0%</td>
<td>96.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>9.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2017</td>
<td>5.0%</td>
<td>95.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>9.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2018</td>
<td>6.0%</td>
<td>94.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>9.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
<tr>
<td>2019</td>
<td>7.0%</td>
<td>93.0%</td>
<td>0.0%</td>
<td>0.0%</td>
<td>9.0%</td>
<td>0.0%</td>
<td>0.0%</td>
</tr>
</tbody>
</table>

CONCLUSIONS

• Unintentional pediatric marijuana exposures reported to RMPC continue to increase despite public health interventions implemented in Colorado to prevent/reduce toxicity of exposures.
• Treated/evaluated at a healthcare facility without admission was the most common level of care received throughout the study period.
• Severe medical outcomes were rarely reported following unintentional pediatric marijuana exposures.
• The majority of exposures had involved at least a minor effect medical outcome.
• Unintentional pediatric marijuana exposures to edible products started to increase the year prior to recreational marijuana retail establishments opening in Colorado.
• Exposures to edible products remained the most common product type over the study period.
• Interventions previously implemented on marijuana products may not have been enough to reduce unintentional pediatric marijuana exposures.
• More studies evaluating the root cause of these exposures should be performed to aid in the development of more effective intervention strategies.

LIMITATIONS

• National Poison Data System data rely on voluntary, self-report.
  – Not all exposures are reported.
• While new generic codes were introduced for different types of marijuana products, accuracy of product coding by poison centers may result in under and over reporting of certain marijuana product types.
Adolescent Marijuana Exposures Reported to the Rocky Mountain Poison Center

Delva-Clark Heather¹, Wang George Sam², Ryall Karen A¹, Reynolds Kate M¹, Iwanicki Janetta L¹, Hoyte Chris¹
1. Rocky Mountain Poison & Drug Safety – Denver Health, Denver, CO 2.University of Colorado Anschutz Medical Campus – Children’s Hospital Colorado, Aurora, CO

INTRODUCTION

- Colorado initiated the sale of recreational marijuana in retail establishments in 2014.
- Surveillance research has demonstrated self-reported use of marijuana by adolescents has not increased since 2014.
- The objective of this analysis is to describe annual trends and characteristics of adolescent marijuana exposures reported to Rocky Mountain Poison Center (RMPC) from 2010 through 2019.

METHODS

- National Poison Data System queried for exposures involving ≥1 generic marijuana code
- Inclusion criteria:
  - 13 to 17 years old
  - Exposure date of 01 January 2010 to 31 December 2019
  - Exposure reported to RMPC
- Exclusion Criteria:
  - Confirmed non-exposure
  - Exposure to a synthetic cannabinoid product only or a cannabidiol product

RESULTS

- 573 adolescent exposures to marijuana products reported to RMPC from 2010-2019 (Figure 1).
- Overall, treated/evaluated at a healthcare facility without admission was the most common level of care received (58.2%).
  - Patient lost to follow-up/left against medical advice (15.8%); admitted to critical care unit (8.9%); admitted to non-critical care unit (8.5%); admitted to psychiatric facility (5.6%); patient refused referral/did not arrive at healthcare facility (3.1%)
- Exposures most often resulted in minor or moderate effect (Table 1).
  - Overall, the majority of exposures involved a plant product (68.4%; Figure 2).
  - 31.8% decrease in exposures involving plant products since the initiation of recreational marijuana sales in retail establishments (2014-2019).
  - Edible marijuana product exposures were reported beginning in 2013 and increased through 2018, followed by a slight decrease 2019 (Figure 2).
  - Very few exposures to vaping marijuana products have been reported (2017: n=1; 2018: n=2; 2019: n=8; Figure 2).
  - Exposures involving an unknown marijuana product increased from 2015 (n=2) to 2019 (n=30; Figure 2).
  - Very few exposures to capsule/pill products and pharmaceutical preparations were reported (Figure 2).

CONCLUSIONS

- Adolescent exposures to marijuana products reported to RMPC have steadily increased following the initiation of sales of recreational marijuana.
- The type of marijuana product changed over the study period.
  - Plant marijuana products remain the most common type of product involved.
  - Exposures to edible products increased following the legal sale of recreational marijuana in retail establishments.
  - Edible products were reported almost as frequently as plant products in 2019.
- More studies evaluating exposure characteristics, specifically product type, may help guide development of targeted intervention strategies.
- Exposures involving an unknown marijuana product have increased annually.
  - Improving poison center education around marijuana product identification may aid in this effort.

LIMITATIONS

- National Poison Data System data rely on voluntary, self-report.
  - Not all exposures are reported.
- While new generic codes were introduced for different types of marijuana products, accuracy of product coding by poison centers may result in under and over reporting of certain marijuana product types.

Table. Adolescent Marijuana Exposures Products Reported to RMPC by Medical Outcome (2010-2019)

<table>
<thead>
<tr>
<th>Year</th>
<th>Death</th>
<th>Major Effect</th>
<th>Moderate Effect</th>
<th>Minor Effect</th>
<th>No Effect</th>
<th>Not Followed</th>
<th>Unrelated</th>
</tr>
</thead>
<tbody>
<tr>
<td>2010</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>2011</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2012</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2013</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2014</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>2015</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<tr>
<td>2016</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
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<td>0</td>
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<tr>
<td>2017</td>
<td>0</td>
<td>0</td>
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<td>2018</td>
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<td>2019</td>
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<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Figure 1. Adolescent Marijuana Exposures Reported to RMPC (2010-2019)

Figure 2. Adolescent Marijuana Exposures Reported to RMPC by Product Type (2010-2019)

*Only 1 exposure in a capsule/pill was reported (2017); no exposures in a topical/preparation were reported.
## What to Do with Manganese Neurotoxicity due to Liver Dysfunction?

**Diana Dean, MD\(^1,2\)** **Lydia Baltarowich, MD\(^1,2\)**

\(^1\)Michigan Poison Center at Wayne State University School of Medicine, \(^2\)Henry Ford Hospital, Detroit MI

### BACKGROUND

- Manganese (Mn) neurotoxicity or “Manganism”, manifests as an extrapyramidal (EPS) movement disorder, which results from a selective accumulation of Mn in the globus pallidus.
- Although it is most commonly associated with chronic occupational Mn exposures, chronic liver disease is also known to predispose to Mn neurotoxicity, due to decreased biliary excretion of Mn.

### CASE REPORT

- 15-year-old M with PMHx ulcerative colitis, primary sclerosing cholangitis, autoimmune hepatitis, cirrhosis with portal hypertension.
- Admitted for recurrent episodes of abdominal pain.
- During hospitalization, he was noted to have episodes of upper extremity rigidity and tremors, associated with anxiety and mild altered mental status.
- Neurology service was consulted; EEG was negative for seizures.
- Brain MRI: bilateral increased T1 signal changes in the basal ganglia, especially in the globus pallidi, consistent with possible Mn deposition related to patient’s chronic liver failure. (See Image 1)
- Medical Toxicology Service was consulted for “possible chelation therapy”.
- On examination, mental status was AAOx3, no motor weakness, normal cranial nerve exam. Neuromuscular exam demonstrated resting hand tremor and mild cogwheel rigidity of upper extremities on range of motion, which was intermittent. Lower extremity exam unremarkable.
- Send out manganese and heavy metal testing was recommended and low Mn diet.
- Chelation with CaNa2EDTA was not recommended recommended because, except for the patient’s hand tremor, his EPS findings had resolved and did not recur on repeat examinations.
- Three weeks after evaluation, he received an orthotopic liver transplantation.
- Three month follow-up revealed resolution of his intermittent symptoms.

### LABORATORY RESULTS

- Electrolytes unremarkable: BUN 4.0, Cr 0.30
- AST 28, ALT 31, T Bili 3.88, D Bili 1.49, INR 1.44
- Hgb was 12.0 g/dL, serum Fe 114 mcg/dl (50-212), TIBC 229 mcg/dl (250-450), Ferritin 29 ng/mL (24-336)
- Blood Pb < 5.0; serum Cu 45 mcg/dl (76-166)
- Send-out testing received 5 days later:
  - Serum Mn level 2.8 mcg/L (< 2.5)
  - 24-hour urine heavy metals (As, Cd, Hg & Mn) were negative (< 1.0 mcg/L); urine Cu & Zn were normal

### CLINICAL DISCUSSION

- How common is Mn neurotoxicity in cirrhotic patients?
- What diagnostic testing is most beneficial for dx of manganism?
- What are the indications for Mn chelation with CaNa2 EDTA in cirrhotic patients?
- Efficacy of chelation may depend on whether the degree of neurotoxicity is reversible or irreversible, therefore:
  - Would the duration of neuro symptoms, early > delayed, affect success of chelation?
  - Would age, pediatric > adult, potentially affect success of chelation?
  - What is a reasonable time frame to expect neurologic improvement following chelation?
- Should any adjunctive treatments be recommended, like Fe or antioxidants?

### IMAGING

**IMAGE 1 (Brain MRI):** “bilateral abnormal increased T1 signal changes in the basal ganglia preferentially globus pallidi... consistent with patient’s known history of liver failure due to possible manganese deposition”

### DISCUSSION

- Biliary excretion accounts for the majority of Mn elimination and thus, chronic liver dysfunction could predispose to elevated Mn levels.
- MRI findings of bilateral T1 weighted signal hyperintensity in the basal ganglia, particularly in the globus pallidi, seen in patients with manganism, have also been observed in patients with cirrhosis and parkinsonian-like clinical features.
- It is unknown to what extent these findings correlate with reversible or irreversible Mn- induced neurologic damage.
- Serum Mn levels do not correlate well with toxicity.
- The sparse literature on chelation of Mn using CaNa2 EDTA suggests that, although it can enhance renal excretion of Mn, there is inconsistent support for a beneficial effect on Mn neurotoxicity and thus, the benefits of chelation are unclear. Perhaps, chelation may be a bridge to liver transplantation, especially in young patients.
- Case reports of patients who had a liver transplant suggest potential improvement of neurologic and MRI abnormalities, and our patient demonstrated post-transplant improvement/resolution of resting hand tremor.

### CONCLUSIONS

- This case presents unique management issues of a young patient with cirrhosis, EPS symptoms, and MRI findings supportive of Mn neurotoxicity.
- Patient age and duration of neurologic symptoms may affect efficacy of chelation but robust data on this clinical entity is lacking.
- The ultimate therapy may be a liver transplant with consideration of chelation as a bridge to transplantation.
- Long-term surveillance of EPS and MRI findings following chelation or transplant are required to further current knowledge.
INTRODUCTION

• Research performed by the American Association of Poison Control Centers (AAPCC) has indicated that many patients in the digital age prefer to use online resources instead of contacting a poison center.
• In response, AAPCC created PoisonHelp.org in 2017 to allow these users to provide self-care for minor exposures. The strategy was to ask simple questions, allowing users to perform home care when appropriate and encourage users exposed to more dangerous products or medicines to contact their regional poison center.
• This is the first report of PoisonHelp.org performance.

METHODS

• The website (www.poisonhelp.org) is designed to provide a triage recommendation within 15-30 seconds.
• Early testing in a variety of age groups indicated that this goal had been achieved.
• The site asks a short series of questions in lay terms to determine the substance, patient age, route of exposure, presence of symptoms and pregnancy status.
• The exposure substance is coded to the appropriate AAPCC generic code for proper identification and case management.
• A standard response was written by the AAPCC PoisonHelp.org committee for each AAPCC generic code. Peer review of each response was performed within the committee and by outside reviewers.
• Final guidelines were approved by the AAPCC Board of Directors.
• Each completed case is uploaded into a unique section of NPDS (data are not commingled with traditional data from regional poison centers).

RESULTS

• In April 2020, PoisonHelp.org was accessed 6,789 times; 3104 (45.7%) were users in the United States.
• The most common sources of referral were Medline and the AAPCC website (aapcc.org). Only two poison centers had users referred from their site. Patient age spanned all age groups (Figure).
• The most common substance categories involved were “Unknown Substance Unlikely to be Drug Products followed by Other Antihistamines Alone (Table); over 380 generic product guidelines were utilized by users in total.
• Over 100,000 complete cases have been received since inception.

CONCLUSIONS

• PoisonHelp.org is an easy-to-use, fast and responsible channel for individuals to address their poisoning concerns.
• Instructions for self-care are provided when appropriate, but referral to their regional poison center is essential if the exposure is more complicated or involves a dangerous substance.
• Future enhancements include enhanced substance identification, refinements of the recommendations, continued product database growth and accessibility, and improvements in reporting functions.
Regional Poison Center Post-Marketing Surveillance Pilot Study: Safety and Effectiveness of Antivenom for the Treatment of Crotalid Envenomation

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1Rocky Mountain Poison & Drug Center - Denver Health, CO
2University of Colorado School of Medicine, Aurora, CO
3Oklahoma Center for Poison and Drug Information – University of Oklahoma College of Pharmacy, Oklahoma City, OK
4Louisiana Poison Control Center – Louisiana State University, Shreveport, LA

BACKGROUND
- Regional poison center (RPC) data have been used to study and describe antivenom treatment for crotalid envenomation.
  - These data are limited as they typically capture only the early antivenom treatment phase and usually include data from a single RPC.
- We performed a multi-center systematic surveillance of antivenom treatment for snakebite envenomation for key safety and effectiveness outcomes, including a 10-day post-discharge follow up of outcomes.

METHODS
- We conducted a prospective observational study of crotalid envenomations at three RPCs:
  - Data collected during routine medical management were captured during the subject’s hospitalization and through direct subject and clinician follow up 10 days post-discharge.

RESULTS
- Ninety five cases were eligible for data collection (Figure 1).
- Nearly half (n=43, 45%) of cases were bitten by rattlesnakes; copperhead (n=22, 23%) and cottonmouth (n=8, 8%) bites were also reported.
- 72 (76%) cases were treated with antivenom (Figure 2).
- Thirty-two (32, 44%) cases were eligible for post discharge follow up; 24 subjects (73%) and 10 clinicians (31%) successfully completed follow up.
  - No Fab2Av patients completed follow up.
  - No FabAv patients experienced recurrence of early or delayed onset HVEs (Table 1).
- Among FabAv cases:
  - Initial control was achieved after the first dose of antivenom in the majority of cases (62.5%, Table 1).
  - Average amount of vials used to achieve initial control was 7.5.
  - Two patients (8.3%) experienced serum sickness symptoms (reported symptoms included: muscle aches, fever, chills and rash).
  - Average length of hospital stay was 46.0 hours.
  - Three (4.2%) patients were readmitted to a healthcare facility.

TABLE 1: KEY SAFETY AND EFFECTIVENESS OUTCOMES IN FABAV-TREATED PATIENTS

<table>
<thead>
<tr>
<th>Outcome</th>
<th>All Cases n (%)</th>
<th>FabAv Cases n (%)</th>
<th>FabAv Cases (Rattlesnake Only) n (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute hypersensitivity reaction</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Initial control</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>After 1st dose</td>
<td>45 (62.5%)</td>
<td>41 (62.1%)</td>
<td>15 (53.6%)</td>
</tr>
<tr>
<td>After 2nd dose</td>
<td>16 (22.2%)</td>
<td>16 (24.2%)</td>
<td>7 (25.0%)</td>
</tr>
<tr>
<td>After 1st or 2nd dose</td>
<td>61 (84.7%)</td>
<td>57 (86.4%)</td>
<td>22 (78.6%)</td>
</tr>
<tr>
<td>Serum sickness</td>
<td>2 (8.3%)</td>
<td>2 (8.7%)</td>
<td>2 (20.0%)</td>
</tr>
<tr>
<td>Recurrence of early HVEs</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
<tr>
<td>Delayed onset HVEs</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
<td>0 (0.0%)</td>
</tr>
</tbody>
</table>

CONCLUSIONS
- This pilot study demonstrated the feasibility of using RPC data from multiple sites with an extended follow up process to evaluate the safety and effectiveness of antivenom in the treatment of crotalid envenomation.
- Additional data should be collected to systematically evaluate key outcomes and to compare the safety and effectiveness of antivenom treatments.

LIMITATIONS
- The RPC was unable to identify the type of crotaline snake involved in 23% of cases.
- Small overall sample size:
  - Few cases received Fab2Av (5 of 72 cases).
  - Limited our ability to make comparisons between the treatment types.
  - Few cases with completed post discharge follow up.
  - Limited our ability to observe key outcomes.
- We were unable to control for confounding (e.g., snakebite severity, preexisting medical conditions).

DISCLOSURE
This study was funded by BTG Specialty Pharmaceuticals. RMPDS study authors maintained control over study design, data collection and analysis, reporting, and decisions to present and publish.
IMPLEMENTATION AND EVALUATION OF A NALOXONE ACCESS PROGRAM IN THE EMERGENCY DEPARTMENT

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University of Illinois Hospital & Health Sciences System, Chicago, IL

BACKGROUND

- From July 2016-September 2017, US Emergency Department (ED) opioid overdose related visits increased 35% to 142,561.
- In Illinois, opioid overdose mortality has increased 82% between 2013 and 2016 with 1,946 deaths recorded in 2016.
- Increased access to naloxone is critical for reducing death rates from opioid overdose, yet community access is limited.
- Opioid use disorder patients face additional barriers: knowing how and where to obtain it, financial implications, and provider stigma.
- State pharmacy law may preclude ED discharge prescription dispensing.

METHODS

- A pilot ED process was developed and implemented at UIHHS to provide naloxone and counseling to opioid overdose patients prior to discharge.

RESULTS

DEMOGRAPHICS

<table>
<thead>
<tr>
<th></th>
<th>Pre-pilot (N=241)</th>
<th>Post-pilot (N=40)</th>
<th>Total (N=281)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, years, mean (SD)</td>
<td>46 (13)</td>
<td>49 (13)</td>
<td>47 (13)</td>
</tr>
<tr>
<td>Male sex</td>
<td>186 (77)</td>
<td>35 (88)</td>
<td>221 (79)</td>
</tr>
<tr>
<td>Black</td>
<td>124 (52)</td>
<td>24 (60)</td>
<td>148 (53)</td>
</tr>
</tbody>
</table>


Naloxone distribution and counseling to opioid overdose patients prior to discharge.

- Request naloxone counseling from pharmacist
- Dispense, counsel and deliver intranasal naloxone to patient at bedside
- Document naloxone dispensed in patient chart

STUDY DESIGN & OUTCOMES

- Retrospective study design
- Short post-pilot period comparison
- Single center study (multiple hospitals in area)

FUTURE DIRECTIONS

- Further data is needed to evaluate the impact the naloxone distribution program has on reducing opioid overdose mortality rates.

REFERENCES


CONCLUSION

- A naloxone take-home program is an imperative step to increasing access to a life-saving medication.
- Collaboration with outpatient pharmacy allowed for an innovative process.
- Implementation of the program was feasible with low institution costs.
- Additional physician education is needed to ensure eligible patients are captured.

LIMITATIONS

- Retrospective study design
- Short post-pilot period comparison
- Single center study (multiple hospitals in area)

DISCUSSION

- A naloxone take-home program is an imperative step to increasing access to a life-saving medication.
- Collaboration with outpatient pharmacy allowed for an innovative process.
- Implementation of the program was feasible with low institution costs.
- Additional physician education is needed to ensure eligible patients are captured.
Cholinergic crisis resulting from acute oral pilocarpine hydrochloride overdose:
Xerostomia be gone!

Maros Cunderlik, MD | Anst Gelin, MD | Jill Topeff, PharmD | Justin Corcoran, MD | Travis Olives, MD MPH MEd
Hennepin Healthcare | Minnesota Poison Control System | Minneapolis, Minnesota

Background
• Pilocarpine, an oral muscarinic agent, is increasingly used as second line treatment for xerostomia. Mild cholinergic effects are common, but life-threatening intentional overdoses are rare. Intentional overdose with ophthalmic pilocarpine is previously described, but intentional overdose of the oral formulation is not. Here we present a case of respiratory failure from intentional overdose with oral pilocarpine hydrochloride.

Case Report
• 64-year-old female with xerostomia and past suicidality presented to the emergency department in respiratory distress
• Reported ingestion of #60, 5mg tablets of pilocarpine hydrochloride
• Prescribed 3d earlier by her PCP to treat xerostomia
• Spouse reported a normal state of health the evening before presentation
• EMS identified an empty bottle of pilocarpine hydrochloride at the scene, consistent with the reported ingestion
• On arrival: Hypoxic respiratory failure presumed secondary to bronchorrhea in light of copious secretions
• Examination:
  - Pulse 86/minute  BP 174/116  RR 31/minute
  - Rectal temp 34.6°C  O₂ saturation 90%
  - Altered sensorium
  - Pupils 2mm, round and nonreactive
  - Marked clear oral secretions
  - Skin warm and dry

Case Report, continued
ED course:
• Low dose atropine (0.5mg, then 2mg intravenously) failed to control cholinergic crisis; uneventfully intubated.
• Presenting laboratory assessment:
  • Modest lactic acidosis (4.5 mmol/L, pH 7.28, HCO₃⁻ 19mEq/L), severe hypokalemia (2.6 mEq/L)
  • Undetectable acetaminophen and salicylates
  • Clear CXR
  • Prescribed and emergent medications alone on comprehensive urine testing

ICU course:
• The patient cleared her symptoms within 8 hours
• Extubated on hospital day 1
• Discharged with close psychiatry follow-up, without apparent persistent sequelae. Subsequent visits revealed no persistent or recrudescent symptoms of her exposure.

Case Discussion
• Since 1998, oral pilocarpine hydrochloride has been used to treat xerostomia due to radiation therapy or Sjögren syndrome. Its mechanism of action and capacity to cross the blood:brain barrier suggest a risk of cholinergic crisis with seizures – attributable to its tertiary amine structure – with overdose. This patient presented with profound gastrointestinal and respiratory secretions and possible mild bronchospasm, characteristic of cholinergic crisis. ED providers attempted to prevent intubation with a muscarinic antagonist, but the patient’s acuity forced emergent endotracheal intubation. Routine protective precautions were taken; the regional Poison Center recommended against pralidoxime given a known toxidrome from a direct muscarinic agonist.

Conclusions
• We highlight exposure to a newer formulation of pilocarpine not previously reported in intentional overdose
• Judicious prescribing practices in patients with increased risks of self-harm remain particularly important to prevent exposures
• Although antimuscarinics may resolve cholinergic excess, supportive cares including intubation may yet be necessary
Background

- *Rhaphiolepis indica*, commonly known as Indian hawthorn, is a dense, broadleaf evergreen shrub in the family Rosaceae. *R. indica* can grow to 1.5 m tall and wide and has serrate, oblong-lanceolate leaves.
- The plant blooms in May-June, producing white to pale pink star-shaped flowers. Small, round, blue-black berries develop in August-September.
- The berries contain a single seed and have a tart, astringent taste and are considered inedible when raw but may be eaten once cooked.
- Information on potentially adverse effects from human *R. indica* ingestions is limited.

Methods

- Cases were all *R. indica* ingestions among patients age 5 years or less reported to the Texas Poison Center Network during 2000-2018.
- *R. indica* ingestions were identified by review of records with PoisIndex codes for *R. indica* or “Indian hawthorn” in the Substance Verbatim field.
- The distribution of *R. indica* pediatric ingestions was determined for various factors related to patient demographics, ingestion circumstances, management, and outcome.

Results

- A total of 637 *R. indica* ingestions involving young children were identified. The part(s) of the plant ingested were the berry (n=430, 67.5%), flower (n=13, 2.0%), leaf (n=13, 2.0%), and unknown (n=182, 28.6%).

Results (cont.)

- Of the 317 cases with a reported number of berries ingested, 242 (76.3%) involved a single berry (mean 1.6, range 1-20).
- 358 (56.2%) of the patients were male and 279 (43.8%) female.
- Most (n=624, 98.0%) of the patients were managed on-site.
- The medical outcome was 180 (28.3%) no effect, 7 (1.1%) minor effect, 225 (35.3%) not followed judged nontoxic, 213 (33.4%) not followed-minimal clinical effects possible, 3 (0.5%) unable to follow-potentially toxic, and 9 (1.4%) unrelated effect.
- A clinical effect was reported in 32 (5.0%) of the ingestions. The most frequent clinical effects were vomiting (n=12, 1.9%), diarrhea (n=8, 1.3%), and fever/hyperthermia (n=4, 0.6%).
- The most frequent treatments were dilute/irrigate/wash (n=433, 68.0%) and food/snack (n=93, 14.6%).

Conclusion

- Pediatric *R. indica* ingestions most often involved the berry, usually a single berry.
- The ingestions were seasonal, peaking in October-December.
- The majority (74.6%) involved children age 1-2 years.
- Most *R. indica* ingestions were managed outside of a healthcare facility and did not result in a serious outcome.
A Retrospective Review of Hospitalized Patients Receiving a Higher than Maximum Dose of Acetaminophen (APAP)

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1 Dept. of Emergency Medicine, Division of Medical Toxicology, University of California-San Diego
2 The Department of Pharmacy, UCSD Medical Center
3 California Poison Control System – San Diego Division

INTRODUCTION

- The purpose of this study is to assess the risk of hepatotoxicity associated with APAP doses of greater than four grams per day in the hospital setting.

METHODS

- Retrospective observational analysis over a two-year period at a tertiary care medical center of patients who received more than 4 grams of APAP within any 24-hour period (“dose”).
- Inclusion criteria (see figure 1 above):
  - Initial Liver Function Tests (LFTs): ALT, AST and INR drawn at 24-72 hours after dose
  - Baseline LFTs: drawn within 6 months prior to dose
  - Delayed LFTs: drawn within 10-14 days of dose
  - Potential hepatotoxicity indicated by elevated LFTs which we define as serum ALT or AST > 125 IU/L, or INR ≥ 1.5.

RESULTS

- Our study included 152 cases (N=37,072 total patients) that met 24-hour supratherapeutic dosing criteria (range: 4.2 - 5.85 g).
- Only 10 out of 56 patients with ascensioned initial LFTs had at least one elevation. We excluded 7 of these due to uncollected delayed LFTs.
- 2 of the 3 remaining had at least one elevated delayed LFT, while both also had at least one abnormal baseline measurement. The one individual with normalization of delayed LFTs also had abnormal baseline LFTs as well as concurrent alcohol use history.
- In no cases were the delayed LFT elevations found to be new and persistent.
- No patients received a single dose >4g per single ingestion or >4g more than one consecutive day.
- Alcohol and drug use were also documented. Four patients with abnormally elevated initial LFTs had history of significant alcohol use.
- No patient received N-acetylcysteine or required a liver transplant.
- Death occurred in one individual within 14 days of exposure due to complications of sepsis. Liver dysfunction was not a factor in this patient’s death.

Table 1: Laboratory and substance use history of patients who received a supratherapeutic dose of acetaminophen.

<table>
<thead>
<tr>
<th>Initial Liver Functions (LFTs): ALT, AST and INR drawn at 24-72 hours after dose</th>
<th>Delayed Liver Function Tests (LFTs): drawn within 10-14 days of dose</th>
</tr>
</thead>
<tbody>
<tr>
<td>ELEVATED</td>
<td>ELEVATED</td>
</tr>
<tr>
<td>DEATH WITHIN 14 DAYS OF EXPOSURE</td>
<td>LIVER TRANSPLANT WITHIN 14 DAYS OF EXPOSURE</td>
</tr>
<tr>
<td>ALCOHOL USE ASSOCIATED WITH INITIAL LFT ELEVATION</td>
<td>DEATH WITHIN 14 DAYS OF EXPOSURE</td>
</tr>
<tr>
<td>INCREASED INR ≥ 1.5</td>
<td>LIVER TRANSPLANT WITHIN 14 DAYS OF EXPOSURE</td>
</tr>
</tbody>
</table>

DISCUSSION

- Excessive APAP dosing can occur in the hospital setting due to (1) scheduled dosing extending over the midnight time period with combination products, (2) variable nursing administration schedules, and (3) medication changes resulting from rewritten orders during the transfer to different levels of care.
- Our current study is consistent with reports that acetaminophen therapeutic misadventure is extremely rare. APAP remains one of the safest over-the-counter analgesics.
- Reported poor outcomes after therapeutic misadventures are potentially complicated by inaccurate histories or concomitant comorbidities. Predisposing factors (e.g. fasting or ethanol use) may be associated with greater risk for APAP associated toxicity but subsequent studies in these populations are inconclusive with therapeutic doses.
- There is concern that a subset may be genetically more susceptible to toxicity from lower doses of APAP or other hepatotoxins, but identifiable characteristics of this group are thus far unclear.

LIMITATIONS

- Our study was retrospective and limited by the contents of the medical record.
- We only followed patients out two weeks after the exposure. Although toxicity could have been delayed past that point, this seems unlikely based on the known toxicity syndrome of APAP.
- Finally, our study group was small, and a larger subgroup could have increased the power of our study.

CONCLUSIONS

- In our 2-year review of supratherapeutic dosing of acetaminophen at a tertiary care medical center we did not find any cases of life-threatening hepatotoxicity up to two weeks after the exposure. Larger studies may be needed to expand on and validate our results.
Outcomes of benzonatate exposures reported to a single U.S. poison center: a 20-year review
Corey Cicci, PharmD; Jillian Theobald, MD, PhD; Matthew Stanton, PharmD, BCPS, DABAT; Ryan Feldman, PharmD, BCPS, DABAT
Medical College of Wisconsin; Wisconsin Poison Center

Background
- Benzonatate (BZT) is a commonly prescribed non-narcotic antitussive.1,2
- BZT resembles other topical anesthetics, and toxicity stems from its sodium channel blocking properties.3
- Toxicity can lead to seizures, EKG changes, coma, and death.3,4
- Few data exist describing medical outcomes of BZT ingestions, and no standard treatment guidelines exist.3,5

Purpose
- To characterize clinical outcomes and medical management of BZT ingestions over a 20-year period at a regional poison center (RPC)

Methods
- Design
  o Single-center, retrospective study
- Inclusion Criteria
  o Any BZT exposure
  o Reported to the National Poison Data System (NPDS) and the Wisconsin Poison Center (WPC) between January 1, 2000 and December 31, 2019
- Exclusion Criteria
  o BZT drug information questions
  o Incomplete or irretrievable data
- Statistical Analysis
  o Descriptive statistics

Results

<table>
<thead>
<tr>
<th>Overview</th>
<th>Total Cases</th>
<th>265</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>162 (61%)</td>
<td></td>
</tr>
<tr>
<td>Age, mean (years)</td>
<td>25 ± 22</td>
<td></td>
</tr>
<tr>
<td>Unintentional exposure</td>
<td>160 (60%)</td>
<td></td>
</tr>
<tr>
<td>Polysubstance exposure</td>
<td>92 (33%)</td>
<td></td>
</tr>
</tbody>
</table>

Medical Management for all BZT exposures (n=265), total number of cases requiring below therapy (n = 14; 5%)

Serious Adverse Effects for unintentional ingestions (n = 160) and intentional ingestions (n = 105)

Admission Status for unintentional ingestions (n = 160) and intentional ingestions (n = 105)

Fatal Exposures
- Two deaths occurred (0.8%)
  - Patient #1
    o 17-year-old female with intentional ingestion of BZT, meclizine, and ethanol who presented in cardiac arrest with pulseless electrical activity
    o Therapies: vasopressors, sodium bicarbonate, lipid emulsion
    o Postmortem analysis showed 680 mcg/L BZT level in urine and 150 mcg/L meclizine level in blood
  - Patient #2
    o 63-year-old female with intentional ingestion of BZT, acetaminophen, metformin, and diphenhydramine who developed renal and liver failure
    o Therapies: hemodialysis, liver dialysis, N-acetylcysteine, sodium bicarbonate

Conclusions
- During a 20-year study period at one RPC, BZT exposures involving significant therapeutic interventions and serious toxicity occurred more frequently in intentional ingestions.
- Unintentional ingestions did not result in significant adverse events and infrequently required hospital admission.
- Although BZT can result in serious toxicity, exposures are rare, and most unintentional cases can be managed at home.

References
**Background**

- Dec. 2019 - First cases of COVID-19 reported in China
- March 2020 – The state of Pennsylvania declared a state of emergency and implemented stay at home orders and closure of non-essential businesses
- Liquor stores were among business initially considered non-essential
- Hand sanitizers sold out with the increase in purchases in response to the pandemic

**Objective**

- To determine the association between decreased access to ethanol and increased access to hand sanitizers with toxic alcohol exposures as reported to the Philadelphia Poison Control Center (PHLPCC)

**Methods**

- National Poison Data System (NPDS) was queried for toxic alcohol related calls taken by the PHLPCC from Jan 1st – April 30th from 2019 and 2020
- We used the standardized codes for each exposure type: methanol (0031140), ethylene glycol (0051260) and isopropyl alcohol (0025140, 0025143, 0025141)

**Results**

- Majority of cases involved isopropyl alcohol in both 2019 and 2020 (141 and 243 cases respectively), an increase of 72%
- “Other” included occupational and malicious exposures and adverse reactions

**Conclusions**

- Overall exposures significantly increase in unintentional exposures
- Methanol and ethylene glycol cases not increased in 2020
- Isopropanol cases increased by 102 from 2019 to 2020
- Increases seen in age groups 1-5 years, 6-12 years and 40-59 years
- Majority of exposures due to ingestion (75%)
- Increase in cases associated with timing of quarantine

**Future Work**

- Investigate associated trend of alcohol withdrawal during same time period
- Investigate cause of ethylene glycol cases from 2019
Disinfectant and Hand Sanitizer Product Exposures in Italy: a “side effect” of the COVID-19 Pandemic

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1. Milan Poison Control Center, ASST Grande Ospedale Metropolitano Niguarda Milan, Italy. 2. Emergency Medical Services Injury Prevention, Hawaii State.

### Background

During the first four months of 2020, Italy reported 205,463 COVID-19 exposures and 27,967 deaths. Public health messaging emphasized use of disinfectant and hand sanitizer products to reduce SARS-CoV-2 exposure, the agent responsible for COVID-19. Our aim was to analyse these exposures and compare to the same period in 2019.

### Methods

We used descriptive statistics to analyse Milan PC toxicity-consultation-volumes for ethanol-based hand sanitizers, hypochlorite bleaches, denatured alcohols and unspecified disinfectants such as cationic and hydrogen peroxide disinfectants, for the period 1 January 2019 – 30 April 2019 to the same period in 2020.

### Results

#### Milan PC Exposures 1 January 2019 - 30 April 2019 and 2020. (Table 1). During the 2020 study period an increase in exposures of 63.6% compared to 2019 was observed. For 2020, age group distribution was: <5 years (25%), 5-<18 years (7%); ≥18 years (68%). Exposure reason by case category: Unintentional - 57%, intentional exposure - 9% (suicide - 8%, abuse - 1%) and misuse - 34% (17% mixing products, 16% diluting, 1% other). Route of exposure: ingestion - 60.1% inhalation - 29.9%, ocular - 5%, other -5%. 48% had symptoms: respiratory - 22%, gastrointestinal - 12%. Most frequent clinical effects: nausea, vomiting, coughing, choking and ocular inflammation. Most were managed at home (69.5%). Moderate symptoms were reported in 9.6% of all exposures and in 5.6% of unintentional exposures. No deaths were reported.

### Conclusion

Public health messaging advocating the use of these products was necessary to mitigate CORVID-19 health effects. The Milan PC exposure increases were similar to those observed in the US\textsuperscript{1}. Exposure data from both countries demonstrated a temporal association with the pandemic. In Italy the main problem appears to be linked to improper transfer from the original container and mixing of incompatible products. Based on these findings, PC public health messaging should emphasize proper use of these products.
Background
➢ The opioid epidemic is one of the largest public health crises in the United States
➢ In 2018, there were over 40,000 deaths nationwide and 1,116 deaths in Philadelphia related to opioid overdoses
➢ Naloxone is safe and effective as an opioid overdose reversal agent
➢ There are real and perceived barriers preventing well-intentioned people from obtaining and carrying naloxone

Methods
➢ Questionnaire sent via REDCap to practicing physicians and APPs within an Emergency Department at an urban tertiary care facility
➢ Information collected included: current carriers of naloxone and where it was obtained, previous use of naloxone, barriers to obtaining naloxone, willingness to carry naloxone, residential location and transportation for commuting to work

Results
➢ 109 total respondents
➢ Only 10% of respondents currently carry naloxone
➢ 89% of respondents are willing to carry naloxone
➢ In the last year, 19% of respondents have found an opportunity to use naloxone outside of the hospital with a total of 55 incidents
➢ Majority of reported limitations was due to lack of knowledge of standing order in our state

Conclusions
➢ We propose a program that will mitigate the negative factors preventing staff from carrying naloxone
➢ Naloxone Rescue Project:
  ○ To promote staff's ability to carry naloxone on their person outside of the Emergency Department
  ○ To provide training and distribution of opioid overdose reversal kits
  ○ To encourage highly trained physicians and APPs to be health ambassadors to the surrounding community

Objectives
➢ Create a questionnaire for practicing physicians and advanced practice providers (APP) to better understand real and perceived barriers to carrying naloxone
➢ Depending on findings of questionnaire, propose a departmental program that would fund the training and distribution of naloxone to practicing physicians and APP
Background

- Popular warehouse-style mass-quantity retailers sell products with more xenobiotic in a single container for minimizing cost per xenobiotic unit.
- These products are considered to be over-the-counter (OTC), and available for purchase in large quantities without a prescription.

Objectives

- Explore whether OTC pharmaceuticals at these retailers contained enough product to cause significant toxicity if an individual was exposed to the entire contents of a single package.

Methods

- Product searches were performed at three major mass-quantity retailers: BJ’s Wholesale Club, COSTCO, and Sam’s Club.
- “Significant toxicity” was determined by the authors’ clinical experience along with the medical literature.
- Most common items queried listed below:
  - Acetaminophen
  - Diphenhydramine
  - Ferrous sulfate
  - Ibuprofen
  - Loperamide
  - Naproxen
  - Salicylates
  - Other potentially toxic xenobiotics included oil of wintergreen, nicotine, and hydrogen peroxide.

Results

- The table below highlights maximum amounts of xenobiotic sold as one unit at each retailer.

<table>
<thead>
<tr>
<th></th>
<th>BJ’s</th>
<th>COSTCO</th>
<th>Sam’s Club</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acetaminophen 650mg, 500mg</td>
<td>Tabs: #400 Max. dose: 260g</td>
<td>Tabs: #1000 Max. dose: 500g</td>
<td>Tabs: #1200 Max. dose: 600g</td>
</tr>
<tr>
<td>Diphenhydramine 25mg</td>
<td>Tabs: #144 Max. dose: 3.6g</td>
<td>Tabs: #600 Max. dose: 15g</td>
<td>Tabs: #600 Max. dose: 15g</td>
</tr>
<tr>
<td>Ferrous Sulfate (elemental,65mg)</td>
<td>Tabs: #365 Max. dose: 23.725g</td>
<td>Tabs: #365 Max. dose: 23.725g</td>
<td>Tabs: #300 Max. dose: 19.5g</td>
</tr>
<tr>
<td>Ibuprofen 200mg</td>
<td>Tabs: #750 Max. dose: 150g</td>
<td>Tabs: #1000 Max. dose: 200g</td>
<td>Tabs: #1200 Max. dose: 240g</td>
</tr>
<tr>
<td>Loperamide 2mg</td>
<td>Tabs: #192 Max. dose: 384mg</td>
<td>Tabs: #200 Max. dose: 400mg</td>
<td>N/A</td>
</tr>
<tr>
<td>Naproxen 220mg</td>
<td>Tabs: #400 Max. dose: 88g</td>
<td>Tabs: #320 Max. dose: 70.4g</td>
<td>Tabs: #320 Max. dose: 70.4g</td>
</tr>
<tr>
<td>Salicylates (aspirin,325mg)</td>
<td>Tabs: #500 Max. dose: 162.5g</td>
<td>Tabs: #500 Max. dose: 162.5g</td>
<td>Tabs: #500 Max. dose: 162.5g</td>
</tr>
</tbody>
</table>

- At least seventy (70) unique products contain enough single xenobiotic or combination thereof to cause significant toxicity.
- Products were noted to be sold in single or combination xenobiotic units.
- Seven common xenobiotics were notable to be sold in single units with amounts that could cause significant toxicity in pediatric and adult patients if ingested as a whole unit.
- Other potentially toxic xenobiotics included oil of wintergreen, nicotine and hydrogen peroxide.

Conclusions

Mass-quantity retailers sell potentially dangerous xenobiotics in quantities sufficient to cause significant toxicity by exposure to one container. This is important for physicians and other providers to consider for maximum exposure calculations from a single container.

Providers should maintain awareness of the potential for toxicity from exposure to a single container obtained from a mass-quantity retailer.
Serial Bicarbonate Monitoring in Toxic Alcohol Management
Alexa Camarena-Michel MD, Christopher Hoyte MD
1Rocky Mountain Poison & Drug Center - Denver Health and Hospital Authority, CO, USA

Background
• Suspicion for toxic alcohol exposure results in common calls to poison centers.
• Availability of diagnostic testing for toxic alcohols is highly variable, particularly in nonmetro areas.
• Serial bicarbonate monitoring may be useful for management decisions.

Results
• 567 cases identified in 2019.
• 103 of these were seen at health-care facility (HCF) and had labs performed.
• Table 1 depicts patient management in 5 distinct groups.
• Table 2 outlines management of patients who reported methanol (MeOH) or ethylene glycol (EG) exposures and had serial bicarbonate measurements.
• Table 3 shows that confirmatory testing supported the use of serial bicarbonate measurements (Group 1).
• All patients who did not receive 4-MP using serial bicarbonate monitoring (Group 1) had clinical improvement and were discharged.
• Table 3 also illustrates patients who received empiric 4-MP and did not have a metabolic acidosis (Group 3), 4 had an elevated EG/MeOH and 6 had negative EG or MeOH measurements.
• Lastly, in 11 cases (Group 4), EG and MeOH resulted so quickly that initial management was dictated by these results.

Conclusions
• Management of EG and MeOH exposures is highly variable.
• Unnecessary administration of 4-methylpyrazole increased length of stay and hospital costs.
• In this small retrospective analysis, serial bicarbonate measurements were used to rule out clinically significant EG and MeOH exposures.
• More studies are needed to assess if serial bicarbonate concentrations are sufficient substitutes to obtaining toxic alcohol concentrations.

Objective
• To determine the effectiveness of monitoring serial bicarbonate concentrations for suspected toxic alcohol poisoning at large regional poison centers.

Methods
• The National Poison Data System (NPDS) was queried for six generic codes between 1/1/2019-12/31/2019.
• Age, gender, bicarbonate concentrations, renal function, outcomes, treatments administered, and toxic alcohol concentrations were collected.
• Descriptive statistics were utilized.

Table 1
Varying Methods of Evaluation

<table>
<thead>
<tr>
<th>Group</th>
<th>Number of patients (N= 103)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>54</td>
</tr>
<tr>
<td>Group 2</td>
<td>17</td>
</tr>
<tr>
<td>Group 3</td>
<td>14</td>
</tr>
<tr>
<td>Group 4</td>
<td>11</td>
</tr>
<tr>
<td>Group 5</td>
<td>7</td>
</tr>
</tbody>
</table>

Group 1 = Serial bicarbonate measurements
Group 2 = Prophylactic 4-MP with metabolic acidosis
Group 3 = Prophylactic 4-MP without metabolic acidosis
Group 4 = Laboratory ethylene glycol and methanol measurements
Group 5 = Left AMA

Table 2
Management of Patients with Serial HCO₃ Measurements

<table>
<thead>
<tr>
<th></th>
<th>Treated with 4-MP</th>
<th>Not Treated w 4-MP</th>
</tr>
</thead>
<tbody>
<tr>
<td>Number of patients (N= 54)</td>
<td>8</td>
<td>46</td>
</tr>
</tbody>
</table>

Table 3
Confirmatory Testing in Patients with Serial HCO₃ Measurements

<table>
<thead>
<tr>
<th></th>
<th>Treated, confirmed positive</th>
<th>Treated, confirmed negative</th>
<th>Not Treated, confirmed negative</th>
<th>Not Treated, confirmed positive</th>
</tr>
</thead>
<tbody>
<tr>
<td>Group 1</td>
<td>4</td>
<td>0</td>
<td>6</td>
<td>0</td>
</tr>
<tr>
<td>Group 2</td>
<td>9</td>
<td>1</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Group 3</td>
<td>4</td>
<td>6</td>
<td>NA</td>
<td>NA</td>
</tr>
<tr>
<td>Group 4</td>
<td>2</td>
<td>NA</td>
<td>9</td>
<td>NA</td>
</tr>
</tbody>
</table>
Severe Toxicity Associated with Confirmed Aconite Exposure

Vincent J. Calleo, MD; Christine M. Stork, PharmD, DABAT, FAACT; Nikhil Govil, MD; Jeanna M. Marraffa, PharmD, MPH, DABAT, FAACT

1. Upstate New York Poison Center, Syracuse, NY; 2. SUNY Upstate Medical University, Syracuse, NY; 3. Westchester Medical Center, New York Medical College, Valhalla, NY

Background

- Aconite and its related alkaloids are extracted from the root of the Aconitum plant species.
- These substances are thought to cause toxicity by prolonging the opening of sodium channels.
- Common toxic findings include nausea and vomiting, paresthesias, neuromuscular weakness and cardiac dysrhythmias which can result in fatality.

Case Report

An otherwise healthy 33-year-old male presented to the ED with nausea and vomiting. Just prior to arrival, he reported intentionally ingesting aconite root which he had purchased online in an attempt at self-harm. The patient had multiple episodes of vomiting upon arrival, and was unable to tolerate oral activated charcoal (AC). He had intractable vomiting despite receiving 12mg of intravenous ondansetron. His heart rate was 140 beats per minute; his vital signs were otherwise within normal limits. The laboratory results, including basic metabolic panel and magnesium, returned normal. An electrocardiogram (ECG) showed a QRS complex duration of 124ms and a QTc complex duration of 588ms. One hour after arrival, the patient developed a wide complex tachycardia (Figure 1) that was treated successfully using amiodarone followed by a lidocaine infusion (Figure 2). Over the next few hours, the vomiting improved after treatment with metoclopramide. The patient remained hemodynamically stable, and was transferred to the intensive care unit (ICU) at a tertiary care center. Upon arrival to the ICU, his blood pressure was 100/48 mmHg and his heart rate was 95 beats per minute. Shortly after arrival to the ICU, the lidocaine infusion was discontinued. During the course of his critical care stay, the patient developed bradycardia with heart rates between 47-56 beats per minute. This eventually improved to baseline within 36 hours after initial presentation. A remnant of the ingested material was collected and sent to the Laboratory of Organic Analytical Chemistry of the Wadsworth Center, New York State Department of Health for analysis using gas chromatography/mass spectrometry, testing detected mesaconine, aconitine and hypaconitine.

Discussion

- Though infrequently encountered, aconite ingestions can be life threatening.
- Time to toxicity after ingestion of plant material is normally 5 minutes to 4 hours.
- As little as 1 gram of plant material can have life threatening toxicity.
- After ingestion, patients should receive AC as soon as possible if it can be safely tolerated.
- Although there is no definitive treatment after ingestion, there is limited evidence to suggest that amiodarone and flecainide are more effective than other type 1 antiarrhythmics.
- These agents are thought to exert their effects via interactions with the voltage-gated sodium channels that are affected by aconite.
- Interestingly, this patient was given lidocaine after amiodarone and did not have any subsequent dysrhythmias.
- Magnesium has also been used to treat dysrhythmias from aconite poisoning.
- When aconite toxicity is suspected, definitive testing can be performed on available samples of the ingested material as well as on serum blood samples at certain specialty labs.

Dried Aconite Root

Aconite products are widely available online. The toxin, aconitine, is found throughout the plant but is most concentrated in its turnip-shaped root.

Conclusion

- Aconite ingestion can cause severe toxicity with QRS prolongation and cardiac dysrhythmias.
- Laboratory confirmation can be performed if remnants of the ingested substance remain.

References

The Poison Center as Pandemic Response: Establishment and Characteristics of a COVID-19 Hotline through the New Jersey Poison Center

Diane P. Calello¹,², Bruce Ruck¹,², Christopher W. Meaden¹,², and Lewis S. Nelson¹,³

¹. Rutgers New Jersey Medical School, Newark NJ
². New Jersey Poison Information and Education System, Newark NJ

OBJECTIVE

To describe regional poison control center response during the COVID-19 pandemic.

BACKGROUND

Poison Centers are uniquely positioned to respond to a public health crisis as fully operational 24-hour hotlines staffed by healthcare professionals.

The New Jersey Poison Information and Education System (NJPIES) receives more than 50,000 calls annually.

NJPIES has incorporated other hotlines including an AIDS/STD hotline, an addiction consult hotline, and a provider MAT hotline.

Temporary civilian call centers can be established for dissemination of non-medical information to the public.

Poison Centers can provide up-to-date, unbiased, and factual expertise in a crisis with minimal preparation, given existing infrastructure and staffing.

METHODS

January 27, 2020 – NJPIES agreed to operate the NJ State Coronavirus Hotline at the request of the New Jersey Department of Health to provide 24-hour information regarding coronavirus and the state of New Jersey’s evolving response.

We describe call patterns, subject matter, and staffing and infrastructure strategies implemented to meet demand on this novel poison center-based hotline.

RESULTS

From January 27, 2020 to May 27, 2020 NJPIES responded to over 30,000 calls for COVID-19 information.

Callers to the line included: lay public, healthcare professionals, school systems, municipalities, business owners, contacts for the New Jersey Department of Health and other departments.

Call volume showed a steep rise early March 2020, when COVID-19 cases reached severe levels in New Jersey.

CONCLUSIONS

Temporary staff necessitated an abbreviated on-boarding process.

Telework was established for existing staff to allow for flexibility and to ensure adequate staffing in the need for personal quarantine or isolation.

March 16, 2020, NJPIES partnered with NJ-211, a national disaster hotline to answer non-medical inquiries.

Inadvertent publicity of the hotline occurred on non-medical state webpages leading to inappropriate, non-medical calls – these sites were modified in real time at NJPIES request.

Surge of calls required initial increase of hours for existing staff. Further supplementation with health professions students, healthcare community volunteers, governmental staff and new permanent hiring through the University.

An additional 40 phone trunks were required and a triage protocol to prioritize poison calls was developed.
Ocular Symptoms Reported With Vaccine Adverse Events
Arpan Patel³, Abida Bushra³, Alba Caceres³, Mathias B. Forrester⁴
³North Texas Poison Center, Dallas, TX, USA, ⁴Independent Researcher, Austin, TX, USA

Background
- Vaccines are effective in the prevention of infectious diseases. However, adverse effects may occur after vaccination.
- Among these adverse effects are ocular effects. Information on the range of ocular symptoms reported with vaccine adverse events is limited.
- The objective of this study was to characterize ocular symptoms observed among vaccine adverse events reported to the United States Food and Drug Administration.

Methods
- Data was obtained from the Vaccine Adverse Event Reporting System (VAERS).
- Reports were coded using the Medical Dictionary for Regulatory Activities (MedDRA).
- VAERS public data for the years 1991-2018 were downloaded and searched for all records that included a symptom affecting the eye.
- Symptoms involving tissue around the eye were excluded.
- The distribution of adverse events with ocular symptoms was determined for factors related to patient demographics, circumstances of the exposure, specific symptoms, and outcome.

Results
- Among 533,113 total vaccine adverse events that were reported to have occurred during 1991-2018, 14,563 (2.7%) had one or more ocular symptoms.
- Of the 14,421 patients with a known sex, 9,247 (64.1%) were female and 5,174 (35.9%) male.
- The adverse event resulted in an emergency department or doctor visit in 6,460 (44.4%) cases. The adverse event was classified as serious in 2,574 (17.7%) cases: 1,745 (12.0%) hospitalized, 947 (6.5%) disability, 598 (4.1%) life threatening illness, 178 (1.2%) prolonged hospitalization, and 89 (0.6%) death.
- The most commonly reported vaccines were influenza (n=5,461, 37.5%), diphtheria-pertussis-tetanus (n=1,975, 13.6%), hepatitis B (n=1,583, 10.9%), measles-mumps-rubella (n=1,512, 10.4%), human papilloma virus (n=1,452, 10.0%), and pneumococcal (n=1,232, 8.5%).

Conclusion
- Even though the number of vaccine adverse events with ocular symptoms increased over the time period, the proportion of total vaccine adverse events with ocular symptoms remained steady.
- Although 44% of the adverse events resulted in an emergency department or doctor visit, there were few (18%) serious adverse events.
- It should be noted that the vaccine may not have caused the reported ocular symptom. The ocular symptom may have been related to an underlying condition, another drug or reason.
Identification of a Novel Synthetic Cathinone in a Patient Presenting After an Overdose

Bux ME, Micciche AF, Westover RC, Shao S, Sidlak AM, Lynch MJ
Division of Medical Toxicology, Department of Emergency Medicine, University of Pittsburgh School of Medicine, Pittsburgh, USA

Background
- Synthetic cathinones (commonly known as “bath salts”) have been derived from cathinone, the stimulant found in khat (*Catha edulis*).
- Synthetic cathinones are categorized as sympathomimetic amines, similar in structure to amphetamines, and have emerged as recreational drugs of abuse.
- Although many analogs are known, they are difficult to detect and are infrequently identified in patients presenting with overdose.

Case Report
- 22-year-old male with history of depression & previous overdose complicated by cardiac arrest due to torsades-de-pointes.
- Presented to ED after out-of-hospital seizure
- On arrival:
  - Obtunded
  - Tachycardic
  - Hyperthermic
  - Rhabdomyolysis
  - Sustained Clonus
- EKG without QRS or QTc prolongation.
- Comprehensive urine drug screen via liquid chromatography - mass spectroscopy (LC-MS):
  - 4-methyl-α-pyrrolidinobutiophenone (MPBP)
  - Bupropion
  - Buprenorphine
  - Venlafaxine
  - Chlorcyclizine
  - Quetiapine
  - Hydroxyzine
  - Viloxazine
  - Dextrometorphan
- MPBP was not detected on initial gas chromatography – mass spectroscopy.
- Admitted initially to the ICU, with serotonin syndrome and encephalopathy gradually resolving over the course of six days.

Discussion
- Not much is known regarding the pharmacokinetics or pharmacodynamics of MPBP
- Structurally similar to pyrovalerone, which has sympathomimetic and serotonergic effects
- Given the large peak for MPBP on LC-MS, it is predicted to have contributed to toxicity, however the presence of many other drugs (notably bupropion) obscures its true contribution

Conclusion
- We present a case report of a patient presenting with toxic encephalopathy and serotonin syndrome following a polypharmacy overdose.
- MPBP was detected in urine via LC-MS and is predicted to have contributed to his overall toxicity.
- This is the first case report in the medical literature that documents detection of MPBP in a patient.
- Use of LC-MS may identify the presence of synthetic cathinones not detectable by traditional GC-MS analysis.
The Perils of Hydrogen Peroxide 35%: A Case Series Involving Multiple Imaging Modalities
Rebecca Bruccoleri, MD1, T. Christy Hallett, MD2, Allison Weatherly, MD2, Justin Loden, PharmD3, Scott Muir, RN3
1. Tennessee Poison Center, Nashville, TN, 2. Vanderbilt Children’s Hospital, Nashville, TN

Background:
Hydrogen Peroxide 35% has been promoted as a non-FDA approved treatment for multiple diseases including cancer and HIV and can liberate large amounts of oxygen (100cc per ml of solution).

Case Series:

Case 1: 22 y/o man with h/o hepatitis C
Scenario: Unintentionally ingested ~60-120 cc of hydrogen peroxide 35% 
Symptoms: Abdominal pain, nausea, and vomiting
Imaging: CT abdomen/pelvis showed portal venous gas (PVG) Endoscopy showed minimal superficial grade burn (unknown location).
Hospital Course: Patient treated with hyperbaric oxygen for 6 hours. Repeat CT showed gastric thickening, no perforation, and resolution of venous emboli. Discharged on HD 3.

Case 2: 3 y/o girl
Scenario: Ingested unknown amount of 35% hydrogen peroxide
Symptoms: Vomiting multiple times, red-stringed emesis, and epigastric tenderness
Imaging: Normal abdominal xray, CT showed trace portal venous gas in right lower lobe of liver, EGD gastritis and unremarkable esophagus
Hospital Course: Symptoms resolved and patient discharged on HD 3.

Case 3: A 3 y/o boy
Scenario: Unintentionally ingested “2 mouthfuls” of 35% hydrogen peroxide
Symptoms: Vomiting and hematemesis
Imaging: Abdominal Xray and CT showed portal venous gas with CT showing mild-moderate PVG. EGD during admission showed diffuse erythematous, edematous, and friable stomach lining without ulcers but normal esophagus. Ultrasound showed PVG.
Hospital Course: Transferred to a referral center and patient was also non-verbal. Head CT was negative for intracranial emboli. Patient had echo which showed no PFO and therefore, patient observed in PICU instead of being transferred again. On hospital day 2, repeat ultrasound showed resolution of portal venous gas. Patient was discharged on HD 4.

Case 3 continued:
Hospital Course: Transferred to a referral center and patient was also non-verbal. Head CT was negative for intracranial emboli. Patient had echo which showed no PFO and therefore, patient observed in PICU instead of being transferred again. On hospital day 2, repeat ultrasound showed resolution of portal venous gas. Patient was discharged on HD 4.

Case 4: 76 y/o woman
Scenario: Ingested between 2.5-5 ml of hydrogen peroxide 35% thinking it was her medication.
Symptoms: Vomiting and GI upset.
Imaging: CT head/chest/abdomen/pelvis showed no emboli
Hospital Course: The following morning her symptoms related to ingestion resolved and the PCC closed the case.

Case 5: 44 y/o woman
Scenario: Ingested a mouthful (~20-30cc) of hydrogen peroxide 35% and then ingested alkaline water
Symptoms: Vomiting and diarrhea.
Imaging: CT abdomen/pelvis was negative.
Hospital Course: Her GI upset resolved and she was discharged from the ED.

Discussion:
Low dose CT can determine the presence of gas emboli in the chest/abdomen/pelvis. Ultrasound can help avoid multiple CT scans to determine the resolution of portal venous gas.

Conclusion:
Multiple imaging modalities including echocardiography can be used to identify and guide management of gas emboli from hydrogen peroxide 35% ingestions which are not uncommon.
Toxicovigilance for suicide prevention following internet promotion of sodium nitrite

Jared Brown1,2,3, Ingrid Berling1, Thanjira Jiranantakan1,2, Nicholas Buckley1,4, Andrew Dawson1,4
1. NSW Poisons Information Centre; 2. NSW Ministry of Health; 3. UNSW Sydney; 4. University of Sydney; Australia

Objectives: To investigate time trends and demographic characteristics of deliberate self-poisonings with sodium nitrite/nitrate following Internet promotion for euthanasia in September 2017.

Methods: Retrospective observational study of:

Participants: Deliberate self-poisonings with sodium nitrite/nitrate.

Main outcome measures: Survival, date, gender, age, setting, geographical location, history of a terminal or psychiatric illness, product.

Results: 66 Australian deliberate self-poisonings (first in 2014). Two-thirds male with a wide age distribution. A shift in age over time was seen where 6% of people were <30 years in 2017-18 vs 50% in 2019-20. Most had a fatal outcome (80%). A sudden and sustained step-increase in poisonings was seen from September 2017 (and the first death). Most cases (83%) had a psychiatric illness and no terminal illness (91%).

Conclusions: The recent promotion of suicide methodology was associated with a dramatic change in harms from sodium nitrite/nitrate. Significant confusion was found with substance identification, most (if not all) were sodium nitRITE (not nitRATE). The signal generated by poisons centre cases was confirmed using national coronial data and pooled poisoning data. The high fatality rate (even when help is sought) and young age is concerning. State public health actions have focused on means restriction, improved antidote stocking and clinical education. National and international collaboration is needed for monitoring promoted lethal substances. Further research is underway on a clinical toxicology case series.

We acknowledge the National Coronial Information System, managed by the Victorian Department of Justice and Community Safety, for providing the coronial data; and the Australian Poisons Information Centres and toxicology services, for providing the poisoning data.
**CASE #1**

80 yo F with PMHx of bilateral mastectomy and lymph node dissection
- Snake bite to R wrist, edema extended proximally
- Developed bullae over next couple of hours
- Initially presented with thrombocytopenia
- Received total of 30 vials of CroFab over the next 47 hrs

**Figure 1:** Extensive bullae on patient’s right upper extremity, extending proximally from snake bite on wrist

**CASE #2**

84 yo F with PMHx of bilateral mastectomy and lymph node dissection
- Snake bite to R thumb
- Localized swelling and violaceous skin changes with streaking erythema to the right forearm
- On presentation to the ED, vitals were stable, coagulation studies within normal limits
- Given the outcome of case #1, more aggressive management was chosen
- After the standard 3 maintenance doses, her swelling receded to the elbow and she was stable for discharge

<table>
<thead>
<tr>
<th>Time (Hours Post Administration)</th>
<th>1</th>
<th>9</th>
<th>14</th>
<th>24</th>
<th>30</th>
<th>36</th>
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</thead>
<tbody>
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<td>Dose (Vials)</td>
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<td>2</td>
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</tr>
</tbody>
</table>

**Figure 2:** Antivenom administration

**CASE #3**

64 yo M with PMHx of chronic left lower extremity lymphedema (unknown etiology)
- Snake bite to L heel
- Local ecchymosis and edema
- Presented with mild thrombocytopenia that normalized 2 hrs after antivenom administration
- Discharged after 24 hrs
- 12 days after discharge, the patient reported increased redness and bruising over the lateral ankle
  - Concern for post-snakebite infection
  - Treated with 10 days of ceftriaxone
- Returned to ED 19 days after the bite with a necrotic ulcer
- Required two debridements of necrotic tissue with subsequent skin grafting

<table>
<thead>
<tr>
<th>Time (Hours Post Administration)</th>
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<tbody>
<tr>
<td>Dose (Vials)</td>
<td>10</td>
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</table>

**Figure 3:** Antivenom administration

**CASE DISCUSSION**

- Necrosis was outcome in 2/3 cases in patients with a history of lymphatic disruption
- May indicate that the lymphatic system is a crucial part of dissemination of the venom after initial injection in human
- Mechanism of lymphatic involvement may be similar to filariasis
  - Parasites initially enter the lymphatic system before migrating into the vascular system
- Venom may accumulate in lymphatics of patients with disrupted flow, resulting in increased local tissue damage and lower incidence of systemic effects

**CONCLUSION**

- The clinical outcomes of these cases revealed a more severe local injury with lymphatic disruption, suggesting that either venom is unable to travel systemically and concentrates at the site of injection or that antivenom therapy is unable to reach the site of the bite
- This case series suggests that **patients with a history of lymphatic disruption may require intensified loading doses prior to switching to maintenance doses**

**REFERENCES**


Rattlesnake Envenomation in the Setting of Disrupted Lymphatic Flow: A Case Series

Molly Brady, Mary Junak, Geoffrey Smelski, PharmD

Department of Pharmacology & Toxicology, The University of Arizona, Tucson, AZ

BACKGROUND

- Rattlesnake envenomation is a pathophysiologically complex process
- **Local effects** include:
  - Pain
  - Hemorrhage
  - Local edema resembling compartment syndrome
  - Ecchymosis
  - Blisters, bullae and necrosis in severe cases
- **Systemic effects** include:
  - Nausea and emesis
  - Hypotension
  - Metallic taste
  - Paresthesias
  - Fasciculations
  - Coagulopathy resembling a disseminated intravascular coagulation-like syndrome
- **Lymphatic flow is a crucial part of dissemination** of venom after initial injection to produce systemic effects

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Figure 2: Antivenom administration

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REFERENCES

Surprising Decrease in the Number of Intentional Self-Harm Cases Among Teenagers Called to U.S. Poison Centers Early in the Coronavirus Pandemic – April, 2020

Edward Bottei¹, MD, OSM, FCCP, FACMT and Daniel Brooks², MD

¹Iowa Poison Control Center, Sioux City, IA; ²Banner Poison & Drug Information Center, Phoenix, AZ

Background
Between 2010 and 2019 U.S. poison control centers (PCCs) noted a 77.5% increase in the number of cases involving teenagers (aged 13-19 years) with exposures to xenobiotics for the purpose of intentional self-harm (ISH). The number of teenage ISH cases among females increased by a staggering 90.6% during that time. The SARS-CoV-19 pandemic has caused drastic social changes throughout the U.S. and world. Social upheaval, isolation and fear have caused significant physical and emotional stress for many. When global society will return to “normal” is unknown. In April of 2020, a PCC made the curious observation that there appeared to be much fewer ISH cases involving teenagers.

Methods
The American Association of Poison Control Center’s National Poison Data System (NPDS) collects data in real time from all 55 U.S. PCCs. This data base was searched (between 1/1/10 and 4/25/20) using the criteria: closed human exposures, intentional-suspect suicide (for reason of exposure), age range 13-19 years; results were divided by gender. Cases without gender data (≤ 0.14% for any year) were excluded. For 2010 through 2019, the average weekly number of teen ISH cases was determined for 2010-2019; from 1/6/19 through 4/25/20 each week was individually searched for the number of teen ISH cases.

Results
The average number of ISH cases among teenagers called to U.S. PCCs peaked at 1,601 in 2017 and remained essentially level through 2019. The weekly average number of teen ISH cases peaked for males at 374 in 2019 and for females at 1,257 in 2017. Overall cases continued to increase for the first 10 weeks of 2020. For weeks 11-16 of 2020, there was a significant decrease in total and female teenage ISH cases. These decreases were statistically significant compared to weeks 11-16 of 2019 and 1-10 of 2020 (Table 1). Figure 1 presents the total number of teen ISH cases per calendar week for the first 16 weeks of both 2019 and 2020.

Discussion
The decrease in teen ISH cases may be due to several factors including: sampling bias (cases not being called to PCCs), increased suicides among this age group without PCC involvement, or a true decrease in teenage ISH exposures. Possible causes for a true decrease in teenage ISH cases include less social trauma (e.g. at school), restructured social (home) support, and communal empathy concerning Coronavirus.

Conclusion
This trend should be tracked through (and after) this pandemic to better understand and prepare for similar events in the future.

Table 1
Average weekly number of cases called to U.S. poison centers involving teenagers exposed to xenobiotics with the intent of self-harm.

<table>
<thead>
<tr>
<th>Time Period</th>
<th>Males</th>
<th>Females</th>
<th>Total</th>
</tr>
</thead>
<tbody>
<tr>
<td>2019 Weeks 11-16 3/17-4/27</td>
<td>390.0</td>
<td>1306.2</td>
<td>1698.3</td>
</tr>
<tr>
<td>2020 Weeks 1-10 1/5-3/14</td>
<td>429.3</td>
<td>1404.9</td>
<td>1836.1</td>
</tr>
<tr>
<td>2020 Weeks 11-16 3/15-4/25</td>
<td>336.0 †§</td>
<td>1041.7 †¶</td>
<td>1379.7 †¶</td>
</tr>
</tbody>
</table>

† P <0.0001 versus 2020 weeks 1-10
§ P =0.0060 versus 2019 weeks 11-16
¶ P <0.0001 versus 2019 weeks 11-16

Figure 1 Cases called to US PCCs involving teenage intentional self-harm exposures by week; 2019-2020
Introduction

In mid-March of 2020, chloroquine diphosphate (CQ-2P) was mentioned as a possible treatment for SARS-CoV-19. The ingestion of a “heaping” teaspoon of a CQ-2P aquarium product led to a fatal overdose in Arizona, USA. In trying to quantify the weight of a “heaping” teaspoon of CQ-2P, the density of CQ-2P could not be found, nor any consistent or scientific definition of the volume of a “heaping” teaspoon.

Methods

The non-compressed density of CQ-2P powder was measured by pouring 50 grams of CQ-2P powder into a 100 mL graduated cylinder. The compressed density was measured by vibrating the cylinder at 10,000 beats per minute until the powder was no longer visibly compacting.

Three differently shaped teaspoons were used. For a heaping teaspoon, as much non-compressed CQ-2P powder as could be loaded on the teaspoon without any sliding off was weighed (Figure 1). For a rounded teaspoon, two researchers agreed on an amount of non-compressed powder that formed a dome above the rim of the teaspoon that appeared to be equal to the depth of the teaspoon (Figure 2). For the level teaspoon, each teaspoon was filled with non-compressed powder and leveled off using a knife.

To determine the weight of a level teaspoon of compressed powder, a rounded teaspoon of bulk powder was compressed into the spoon’s bowl using a flat surface and a force of 150 N. Additional CQ-2P powder was compressed into the teaspoon two additional times before measurements were taken. The teaspoon’s volume was leveled off during the third compression.

The weights of a level, rounded and heaping teaspoon of non-compressed CQ-2P powder, and the weight of a level teaspoon of compressed CQ-2P powder were measured. Each measurement was repeated 10 times with each of the three teaspoons.

Results

The density of non-compressed and compressed CQ-2P powder were 0.756 g/mL and 0.929 g/mL respectively.

Table 1 lists the weight and corresponding volume of a level, rounded and heaping teaspoon of non-compressed CQ-2P powder, and the weight and volume of a level teaspoon of compressed CQ-2P powder.

Discussion

The assumption that one teaspoon is 5 mL or 5 g of a substance does not consider the density of the substance nor the load of material on the teaspoon. There can be as much as a 2.5-fold difference in the weight of CQ-2P powder from a level to rounded teaspoon and a 4-fold difference from level to heaping teaspoon. This information may be helpful to PCC staff making triage decisions, as well as to health care providers when anticipating the severity of an ingestion.

Conclusions

The ingestion of a very small volume of a CQ-2P aquarium product can be fatal. This is the first study to accurately quantify the amount of a powder in a level, rounded and heaping teaspoon.

Table 1

<table>
<thead>
<tr>
<th></th>
<th>Non-Compressed CQ-2P Powder</th>
<th>Compressed CQ-2P Powder</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Teaspoon Load</strong></td>
<td>Level</td>
<td>Rounded</td>
</tr>
<tr>
<td><strong>Weight (g)</strong></td>
<td>3.5</td>
<td>9.2</td>
</tr>
<tr>
<td><strong>Volume (mL)</strong></td>
<td>4.7</td>
<td>12.1</td>
</tr>
</tbody>
</table>

Figure 1
Heaping teaspoon of non-compressed CQ-2P powder.

Figure 2
Rounded teaspoon of non-compressed CQ-2P powder.
Background  Managing multiple cases of elevated blood mercury levels from a widespread elemental mercury contamination is a labor-intensive problem which involved the poison center coordinating multiple local, state and federal entities outside the poison center.

Case Presentation  On Day 15, the PCC received a call from Patient 5A*, indicating a four-ounce vial of elemental mercury broke on a hard surface 15 days prior (Day 1). It was reported that two children, Patients 1A and 2A, briefly played with the mercury while the other parent, Patient 4A, swept up the spill within a few minutes. On Day 8, 1A and 2A developed fever and rash. On Day 18, Outpatient Clinic #1 called the PCC regarding Patient 1A’s mercury exposure. It was now reported that one-fourth pound of Hg was spilled on a couch and carpet 10 days prior (Day 8). Patient 4A reported Hg was found in the family car and Patient 5A subsequently took car to a local car wash to vacuum. On Day 20, Outpatient Clinic #2 called the PCC concerning a relative, Patient 6B, who was also exposed.

On Day 21, the PCC received two separate calls regarding six additional patients (7B, 9B, 10B, 11C, 12C, 13C) linked to this same incident. As the incident continued to expand, one senior SPI was designated to be the PCC’s point person for coordinating the care of all involved patients. On Day 23, the senior CSPI reached out to original family and identified additional patients 3A, 4A, 5A, and 8B. In total, 13 individuals from 3 families, two houses, one car and one school were involved. Both houses and car were extensively contaminated with Hg. The number and timing of Hg spills was uncertain because of different information provided to the various participating agencies. Due to the chronicity of exposures and the lack of data defining a toxic blood Hg level in children, six of the seven children were chelated.

There was a delay in obtaining the DMSA for all patients due to retail pharmacies not stocking DMSA, the cost of the medication and, in some cases, medical insurance issues.

Case Discussion  What began as one call to the PCC on a Sunday afternoon resulted in a major response involving the local HazMat team, three local outpatient clinics, the local hospital, the county and state public health departments, the state department of environmental protection, the regional PEHSU and EPA, and several nationally recognized experts in Hg toxicology. The poison center’s senior CSPI was the UnityPoint for managing close follow-up on all 13 patients, 8 of whom were treated with DMSA.

Conclusion  Utilizing one senior SPI facilitated the continuity of care with the three families and the numerous health care providers at the three outpatient clinics. Follow-up has continued for over 4 months with 338 total call backs to date.

*Each of the 13 individual patients are numbered consecutively, while the 3 households are denoted A, B, and C.

Table 1

<table>
<thead>
<tr>
<th>Patient and Household</th>
<th>Age (years)</th>
<th>Day Test Obtained</th>
<th>Blood (ng Hg/mL)</th>
<th>Chelation with DMSA</th>
<th>24 hour Urine (mcg Hg/24 hrs)</th>
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<tr>
<td>1a</td>
<td>9</td>
<td>15</td>
<td>&gt;200</td>
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<td>&gt;400</td>
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<tr>
<td></td>
<td></td>
<td>24</td>
<td>88</td>
<td>Mid-chelation</td>
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<tr>
<td></td>
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<td>38</td>
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<td>9</td>
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<td>On DMSA: AST 39-&gt;95 IUL; ALT 62-&gt;188 IUL; Neutrophils 1.77 K/mcl (22.8%)</td>
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<tr>
<td>3a</td>
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Iowa Poison Control Center, Sioux City, IA
A Toxic Who Done It – The Antidote for IPE?

Dana M. Bojorquez1, Pauline A. Cawley1

1Pacific University Oregon School of Pharmacy

Background

The Rule
- To achieve and maintain accreditation, Doctor of Pharmacy (PharmD) degree programs must meet the standards set by the Accreditation Council for Pharmacy Education (ACPE)1
- Standard 11: Interprofessional Education (IPE) includes the requirement that students “participate in experiential educational activities with prescribers/student prescribers and other student/professional healthcare team members”2
- Although the term “prescribers” can include physicians, dentists, nurse practitioners, physician assistants, and veterinarians, ACPE has interpreted the Standard to require IPE activities with physicians and their learners (i.e. medical students and residents)

The Obstacle
- Pacific University School of Pharmacy (PUSOP) has the disadvantage of not having a medical school within close proximity, which has made it difficult to plan and execute IPE activities with physicians and their learners
- Previous attempts to recruit the participation of local medical residents yielded poor turnout, even with the provision of a financial incentive
- Prior IPE had also suffered the fate of many classroom activities – a lack of student participation

The Goal
- Create an activity that would be meaningful to pharmacy students, medical students, and medical residents at different stages of their training
- Increase participation by designing the activity so that successful completion would depend upon the collaboration of group members
- Deliver an authentic interprofessional experience compatible with remote participation

Methods

Faculty used PowerPoint to build progressive patient cases in a format similar to the “Choose Your Own Adventure” book series. In order to create a realistic environment conducive to interprofessional collaboration, we chose to capitalize on the limited coverage of toxicology in the curricula of most pharmacy and medical schools. Writing patient cases about toxidromes was designed to even the playing field between group members, regardless of their profession or level of education.

During the activity, participants were divided into small groups, with each group including representatives from both pharmacy and medicine. Groups were asked to work together through two different patient cases: an overdose of Tylenol PM® (Figure 1) and a combined opiate/benzodiazepine overdose (Figure 2). At each time point during the case, groups received new information about the patient and were asked what they wanted to do when the patient’s acetaminophen level comes back at 140 mcg/mL.

Results

Participants included 93 pharmacy students, 7 medical students, 2 physicians, 5 pharmacy faculty, and 4 staff members.

After the activity, participants were asked to complete a survey about the experience. When asked to select a letter grade, the vast majority of participants rated their group as an A or A+ in areas such as respect, communication, and shared decision making. When asked what they found to be the most valuable aspects of the activity, the inclusion of toxicology content was the second most common response (Figure 3).

A frequent comment from pharmacy students was that they appreciated having a medical student or physician to read the ECG and interpret physical exam findings. Multiple medical students stated they were impressed at the speed with which pharmacy students were able to identify medications. In addition, a Western University faculty member expressed his desire to incorporate mandatory participation into future emergency medicine elective courses.

Conclusions

Feedback from “A Toxic Who Done It” supports the idea that toxicology’s limited presence in healthcare curricula may be an advantage when developing IPE.

This activity also demonstrated that IPE can be accomplished remotely without sacrificing authenticity. Initially, the development of virtual IPE was an attempt to overcome the physical distance between collaborating programs; however, with the advent of COVID-19, the potential applications have expanded tremendously.

References

THE EFFECTS OF LIMB ELEVATION ON REPORTED PAIN AND SWELLING FROM NORTH AMERICAN CROTALID ENVENOMATIONS

Michael C Beuhler | Patricia M Beuhler
North Carolina Poison Control and Atrium Health, Charlotte NC

BACKGROUND

- Crotalid (rattlesnake & Agkistrodon) limb envenomations can result in significant morbidity due to local tissue damage and swelling.
- There is no standard of care regarding limb elevation in these cases.
- If elevation improves pain and swelling, it could potentially reduce the amount of antivenom and analgesia used.
- Studies of the effect of elevation on the clinical course of crotalid limb envenomations are lacking.

METHODS

- Case notes (and electronic hospital records when available) were reviewed with collection of the patient’s age, type of snake, body location bitten, presence of swelling, antivenom treatment (CroFab®), and the amount of elevation (full, partial or none).
- The primary question “if pain or swelling reoccurred when elevation stopped, or was pain/swelling better with elevation?” has been a standard NCPC assessment question since 2013.
- A random sampling of 10% of cases with the primary elevation question was excluded for not being a crotalid bite (n=365), out of state exposure (n=34), not followed (n=32), drug-seeking behavior (n=29), trunk/neck envenomation (n=11), or age less than or equal to 6 years (n=108).
- The majority of cases were due to copperhead/cottonmouth envenomations (83.5%); see Figure 1.
- Elevation (full or partial) was reported in 1736 (87.3%) patients.
- For patients with mild or greater swelling (n=1750), there were 1331 (76.1%) cases where pain/swelling reoccurred when elevation stopped, or pain/swelling was better when elevation was performed; see Table 1.
- A pattern of reported benefit from elevation was observed in all subgroups.
- In the subset with swelling, there was a greater benefit of elevation in the antivenom subgroup compared to the group not treated with antivenom ($\chi_2^2$, p<0.00001).
- For those who received antivenom with documented elevation, the mean number of vials in the full elevation group was 5.7 vials, 6.7 vials in the partial elevation group and 7.0 vials in the group that did not elevate, see Table 2.
- A random sampling of 10% of cases with the primary elevation question documented in the NCPC case and with available hospital records (n=163) demonstrated hospital records only documented the primary elevation question 30% of the time.

RESULTS

- There were 1988 cases included; cases were excluded for not being a crotalid bite (n=365), out of state exposure (n=34), not followed (n=32), drug-seeking behavior (n=29), trunk/neck envenomation (n=11), or age less than or equal to 6 years (n=108).
- The majority of cases were due to copperhead/cottonmouth envenomations (83.5%); see Figure 1.
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- A random sampling of 10% of cases with the primary elevation question documented in the NCPC case and with available hospital records (n=163) demonstrated hospital records only documented the primary elevation question 30% of the time.

CONCLUSIONS

- Limb elevation should be strongly considered for crotalid envenomated adolescent or adult patients as it was associated with improvement in pain and/or swelling in over three times as many patients as those it did not benefit.
- There was an association with elevation providing greater benefit with controlling pain/swelling in patients treated with antivenom and increased elevation requiring less antivenom, however these may have had contribution from other factors.
- It cannot be concluded from this data at what point during the clinical course limb elevation provided benefit as the elevation question could be answered anytime during the case.
- It remains to be seen if this association holds in children as their drug-seeking behavior (n=29), trunk/neck envenomation (n=11), or age less than or equal to 6 years.
BACKGROUND

- North Carolina Poison Control (NCPC) initiated contact with the NC Division of Public Health and within five days activated the COVID-19 information line 1/29/20 (Day 1).
- This line used a dedicated toll-free number and was intended for the public’s COVID-19 concerns.
- The line initially focused on referring suspicious cases to the state epidemiologist for testing.
- When case volume began increasing in late February, additional paid staff were recruited from a pool of allied health students based on pre-existing rotation agreements and relationships with their schools.
- Allied health students were roughly evenly split between nursing, pharmacy and medical.
- The dedicated NCPC COVID-19 information line ceased on Day 92 once the state Division of Public Health established their own call center.
- Funding for the phone line was provided by the Division of Public Health with NCPC initially covering the cost of the additional paid staff.

METHODS

- Retrospective review of NCPC information cases with COVID-19 substance codes 7325206 or 7324190.
- Cases from two early days (Day 6 and 7), the median day (Day 46) and one of the ending days (Day 91) were reviewed by a single researcher.
- The caller’s question was categorized into one of ten categories (Table 1), for cases where the call could not be categorized into a single category, a secondary category was also selected.
- Cases with a secondary question were weighted 0.66 for the primary and 0.33 for the secondary.
- The percentage of each question category during the three time periods was determined.

RESULTS

- A total of 2,219 cases were managed during the 92-day period; the busiest day was Day 35 (3/23) with 988 cases, (Figure 1).
- The busiest days of the week were Tuesdays (16%) and Wednesdays (16.8%); Saturday (10.5%) and Sunday (11.2%) had the least calls (Teal bars in Figure 1).
- Days 41–55.
- The types of questions from the three different time periods are shown in Table 1.
- Questions that were Clinical without symptoms and Travel predominated early while Testing and Clinical with symptoms questions predominated later.

SYSTEM PROCESSES

- To allow for social distancing and continued center operations, 5 additional workstations were set up occupying the conference room in addition to converting 6 office workstations (Figure 2).
- Just-in-time training methods were used to produce a recorded presentation for the trainees covering database use, necessary data points and resource utilization.
- Toxicall® case template and a keycut were provided to increase coding fidelity and decrease documentation times.
- Supplemental (English and Spanish) recorded messages provided information about travel restriction, typical symptoms, the lack of community spread (as was believed at the time) with recordings changing over time.
- The tools required for management should be expected to change over time.
- PCCs can rapidly establish a clinical information line and maintain it for more than 90 days using their existing platforms and additional paid staff recruited from allied health schools.
- Establishing relationships with allied health schools prior to a large-scale public health event was instrumental in fulfilling staffing needs.
- The availability of eager students for nearly around the clock staffing was likely influenced by the lack of classes and not working full time.
- The tools required for management should be expected to change over time.

CONCLUSIONS
### Background

Candlenut comes from the *Aleurites moluccanus* tree. It is often taken as a weight loss supplement. It can be purchased as a raw seed or in capsules. Advertised to have “fat burning properties” and to be a “gentle laxative and diuretic.” It can be readily found online in a product called Nuez Dela India. The recommended dose is ¼ seed per day. It may be taken with or without soaking in hot tea or water. Common side effects include nausea, vomiting, and diarrhea.

### Case Report

A 43-year-old woman was brought to the hospital in the morning by EMS with complaints of a pressure-like sensation in her lower chest and upper abdomen, diaphoresis, nausea, and non-bloody emesis. On arrival, the patient was extremely ill and unable to provide additional history. The patient’s husband reported that she had recently started taking a supplement called Nuez Dela India and was supposed to be taking a quarter of a seed but took a quarter of a cup of seeds the prior evening. Her home medications include buspirone, propranolol, and venlafaxine.

### Case Continued

- **Initial vitals (08:46):** HR 38, BP 85/56, RR 22, SPO2 100% on RA
- **Physical Exam:** Notable for ill appearing, moderate distress, diaphoresis, and bradycardia.
- **Chest X-ray (08:54):** No acute process identified.
- **Initial treatments:** Aspirin 324 mg, Atropine 0.5 mg x2, Morphine 2 mg, 1 L Normal Saline.
- **Digoxin Level (09:31):** < 0.3 ng/mL
- **VBG (10:34):** Notable for pH 7.35, HCO3 19.9, Sodium 125, Potassium 8.7, Ionized Calcium 1.04, Lactate 3.0, Glucose 317
- **Chemistry (11:41):** Sodium 137, Potassium 6.9, Chloride 109, CO2 20, Glucose 51, BUN 11, Creatinine 0.79, Calcium 8.8, Magnesium 1.9

### Case Discussion

- **Physical Exam:** Notable for ill appearing, moderate distress, diaphoresis, and bradycardia.
- **Chest X-ray (08:54):** No acute process identified.
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- **Chemistry (11:41):** Sodium 137, Potassium 6.9, Chloride 109, CO2 20, Glucose 51, BUN 11, Creatinine 0.79, Calcium 8.8, Magnesium 1.9

- **At 12:40pm,** the patient was noted by nursing to be restless and her blood pressure began to decrease. Subsequently her heart rate began to decrease, and she became unresponsive. CPR was initiated. She was emergently intubated. CPR was initiated, but ultimately discontinued after 30 minutes as patient remained in asystole.

- **There are several additional case reports of toxicity related to candlenut use and overdose.** These patients presented with similar symptoms and had cardiac conduction abnormalities that can also be seen with cardiac glycoside toxicity.
- **This patient initially responded to atropine which may have antagonized vagal activation by a cardiac glycoside.**
- **Although the patient had a negative digoxin level this test does not always detect every natural cardiac glycosides.**
- **The patient’s ECG findings of atrial fibrillation with slow response and intraventricular conduction delay are common findings in cardiac glycoside toxicity.**
- **The finding of hyperkalemia with normal creatinine would portend a poor outcome in cardiac glycoside toxicity.**
- **A propranolol overdose would not be expected to cause hyperkalemia or slow atrial fibrillation.**
- **Despite the negative digoxin level the patient may have benefited from a trial of digoxin specific antibody treatment.**

### References

OBJECTIVES

• Pediatric patients frequently present with clonidine and guanfacine poisoning.

• The appropriate management and disposition of the patients is controversial.

• It is not clear how frequently patients with clonidine and guanfacine poisoning require medical interventions after hospitalization that would necessitate admission to an intensive care unit (ICU).

• We performed a retrospective review of pediatric patients with clonidine and guanfacine poisoning managed by our medical toxicology service.

METHODS

• We conducted an IRB exempt, retrospective, single-center chart review using an internal database.

• We reviewed cases from January 2007 through December 2019.

• Patients <18 years old presenting to our affiliated children's hospital with clonidine or guanfacine exposure were included.

• Patients were excluded if medical records were not available for review.

• We assessed coingestants, intent of overdose, location of care provided, medical interventions, length of stay, and hospital outcomes.

RESULTS

• The most common medical interventions were intravenous fluid resuscitation and naloxone. Endotracheal intubation and administration of activated charcoal were uncommon.

• Naloxone was generally under-dosed, with no patient receiving greater than 4 milligrams.

• With the exception of one patient who developed iatrogenic charcoal pneumonitis and one patient who co-ingested a large amount of bupropion, no patients were treated with inotropes or vasopressors, no patient remained on a ventilator for longer than one day, and there were no deaths.

• Almost all medical interventions were performed prior to hospital admission; very few patients underwent any medical intervention after hospital admission.

• When the two unusual patients described above were excluded, only 5% of patients with clonidine exposure, and no patients with guanfacine exposure, underwent post-admission medical intervention.

• The post-admission interventions performed were the administration of atropine (2 cases), glycopyrrolate (1 case), and naloxone (1 case). No patient underwent post-admission intubation or initiation of vasopressors or inotropes.

CONCLUSIONS

• Pediatric clonidine and guanfacine exposures are usually benign and well-tolerated.

• Patients with clonidine and guanfacine exposures rarely require medical intervention after hospitalization, and thus may not require ICU admission.

• There were no deaths in our study that were attributable to the effects of clonidine or guanfacine.
Interplay between Temperature and Rainfall in Rattlesnake Bites Reported to the APDIC from 2017 to 2019
Alisia Z Bahadir PharmD, Bryan Z Wilson MD, Garret Winkler MD, Miguel Pineda MD, Cory Morin PhD, and Steve Dudley MD, DABAT

BACKGROUND: Arizona is not only home to extreme heat, but also home to most rattlesnake bites reported across U.S. poison centers. Since behavior of both rattlesnakes and humans is limited by harsh climate, it is hard to imagine that recent extremes in temperature would not impact seasonal incidence of snakebites. Seasonal analysis of snakebite incidence could provide further insight into potential downstream impacts of global warning such as helping determine if snakebite season is extending or shortening, or if the epidemiology of rattlesnake bite envenomation will shift into new demographics as changing temperatures could drive redistribution of the species. Such information could be helpful for primary prevention strategies and supply of antivenom.

OBJECTIVE: Primary outcome: Identify specific daily temperature and rainfall patterns that are associated with a higher occurrence of snakebites. Secondary outcome: Determine if severity varies across seasonal weather.

METHODS: Retrospective chart review of rattlesnake bites reported from 2017 to 2019 to the Arizona Poison and Drug Information Center (APDIC). Inclusion/Exclusion criteria:

- No evidence of antivenom administered
- No signs/symptoms Dizziness, chills, fasciculations in area of bite site, confusion, lethargy, seizure, strike objects of higher thermal contrast

\[\text{Severe bites} = 0.7802 \times (\text{temperature} - 100) + 0.8753 \times (\text{rainfall} - 0.5) + 0.9729 \times (\text{LD}) + 0.6545 \times (\text{ASS}^3) + 0.1597\]

\[p-value = 0.9729 + 0.6545 \times (\text{ASS}^3) + 0.1597\]

\[\text{Total yearly snakebites} = 0.9729 + 0.6545 \times (\text{ASS}^3) + 0.1597\]

\[\text{No correlation was found with recent rainfall. Other findings in CA showed a positive correlation with seasonal rainfall, however their data was analyzed with cumulative 18-month prior precipitation}\]

\[\text{There was no seasonal variation across all markers of severity. No previous studies have compared differences in ambient temps with\]

\[\text{DISCUSSION:}
\[\text{Temperature ranges from 75-95°F were associated with the highest occurrences of rattlesnake bites.}
\[\text{Daily low temperatures most strongly correlated with increasing severity of rattlesnake bites, which parallels findings from New Mexico. However, there was an upper limit as occurrences declined during July, the hottest month across all three years. This supports the phenomenon of rattlesnake aestivation—a state of dormancy during seasonal extremes in heat or drought.}
\[\text{No correlation was found with recent rainfall. Other findings in CA showed a positive correlation with seasonal rainfall, however their data was analyzed with cumulative 18-month prior precipitation.}
\[\text{There was no seasonal variation across all markers of severity. No previous studies have compared differences in ambient temps with severity but there has been research into pit vipers preferring to strike objects of higher thermal contrast.}

\[\text{LIMITATIONS: Retrospective chart review of limited notes from single poison center. Precision of weather data limited by accuracy of zip code. Weather modeling was performed on a macroscale and excluded days of non-bites. The Abbreviated Snakebite Severity Score has not yet been validated.}

\[\text{CONCLUSION: Most rattlesnake bites occurred in temperatures from 75-95°F with seasonal peaks in late August. There was a significant correlation with increasing temperatures and increasing rattlesnake bites but only during the cooler out-of-season group, suggesting the correlation has an upper limit in temperature. No correlation was found among recent rainfall, and there were no differences in clinical characteristics of snakebites in-season and cooler out-of-season.}

\[\text{REFERENCES:}
\[\text{The authors have nothing to disclose}\]
COVID-19 Crisis Collaboration: The Poison Center and Health Department in the Time of Pandemic
Salvador Baeza, PharmD; Sarah A. Watkins, DO
West Texas Regional Poison Center, Texas Tech University Health Sciences Center El Paso

BACKGROUND
- In early 2020, local, regional, and state agencies planned for COVID-19
  - Texas Dept. of State Health Services opted to operate its own statewide hotline
- El Paso Department of Public Health (DPH) and West Texas Regional Poison Center (WTRPC) collaborated locally
  - Strong history of teamwork on educational programs, preparedness activities, and response initiatives

METHODS
- Existing plans for DPH, its 211 center, and the WTRPC were utilized
  - Based on experience gained through the Flu on Call project

RESULTS
- 493 calls transferred from 211/local COVID-19 hotline between March 10th & July 31st
  - 373 (76%) calls occurred during the 11 days immediately after the initial local case was announced
  - Occasional transfers continue with questions not readily found in DPH’s FAQs

QUESTIONS ASKED
- Request for Testing: 86.7%
- General: COVID-19 Symptoms or Recommendations for Prevention or Travel: 9.8%
- Other healthcare providers or businesses preparing for COVID: 3.5%

DISCUSSION
- Lack of access to testing and the public’s fears resulted in a spike in calls primarily from worried well after 1st local case was confirmed
- Demand subsided after the city opened its own hotline and the availability of community testing grew over the following weeks

CONCLUSION
- The WTRPC was able to effectively support the local health department and serve its community as the pandemic reached El Paso
- Health departments should strongly consider coordinating response efforts with poison centers for public health emergencies
In the setting of intolerance to sulfamethoxazole-trimethoprim, alternative prophylactic agents should be considered in kidney transplant patients to minimize the risk for dapsone-induced methemoglobinemia.

**BACKGROUND**

- Dapsone may be used as a second-line agent for Pneumocystis carinii pneumonia (PCP) prophylaxis in transplant recipients in the setting of allergy or poor response to sulfamethoxazole-trimethoprim (SMX-TMP).
- Challenges may exist in the diagnosis of methemoglobinemia induced by dapsone in organ transplant patients as signs and symptoms at presentation may be non-specific and confused with other complications of the transplant patient that may be immunologic, hematologic, or infectious in nature.

**CASE**

- **PRESENTATION:** 14-year-old male presented to the emergency department with tachycardia, pallor, and fatigue.
- **VITALS:** 119 | 119/72 | 20 | 97.6°F | 96% \(O_2\) saturation RA.
- **PMH:** Two kidney transplant surgeries; asthma; hepatitis B; kidney biopsy: acute cellular- and antibody-mediated rejection.
- **MEDS:** Immunosuppressive therapy and dapsone due to allergy to SMX-TMP.
- **PROGRESSION:** Despite receiving one blood transfusion for serum hemoglobin level of 7.9 g/dL (improved to 8.9 g/dL), patient had persistent peripheral cyanosis and \(O_2\) desaturation in the range of 88 to 89%, requiring high-flow oxygen delivered via nasal canula. Co-oximetry confirmed the diagnosis of methemoglobinemia.

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*Take a picture to see more of my work on the blog, EMPharmD.*

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Sodium Glucose Co-transporter 2 Inhibitor Ingestions Reported To Poison Centers
Maximillian Avila\textsuperscript{a}, Mathias B. Forrester \textsuperscript{b}
\textsuperscript{a}North Texas Poison Center, Dallas, Texas, USA , \textsuperscript{b}Independent Researcher, Austin, Texas, USA

Background
- Sodium glucose co-transporter 2 (SGLT2) inhibitors are a new class of oral antidiabetic medications.
- SGLT2 proteins located in the proximal convoluted tubules of the kidneys are responsible for reabsorbing glucose back into the blood.
- SGLT2 inhibitors allow more glucose to be excreted in the urine, thus reducing the amount of glucose in the blood.
- Adverse clinical effects have been reported with SGLT2 inhibitors.
- The objective of this study was to describe SGLT2 inhibitor ingestions reported to a statewide poison center network.

Methods
- Cases were SGLT2 inhibitor exposures reported to the Texas Poison Center Network during 2013-2018 where the exposure route was ingestion.
- Cases were identified by searching for all records with PoisIndex codes for any of the SGLT2 inhibitors (canagliflozin, dapagliflozin, empagliflozin, ertugliflozin) alone or in combination with other medications.
- Ingestions involving substances in addition to the SGLT2 inhibitor-containing product and ingestions not followed to a final medical outcome were included.
- The distribution of the cases was determined for various factors related to patient demographics, ingestion circumstances, management, and outcome.

Results
- A total of 293 SGLT2 inhibitor ingestions were identified: 137 (46.8%) canagliflozin, 94 (32.1%) dapagliflozin, and 63 (21.5%) empagliflozin (with 1 ingestion involving both canagliflozin and dapagliflozin).
- The distribution of patients by age was 92 (31.4%) 0-5 years, 8 (2.7%) 6-12 years, 15 (5.1%) 13-19 years, and 178 (60.8%) 20 years or older;
- 172 (58.7%) of the patients were female and 121 (41.3%) male.
- The reason for the ingestion was 247 (84.3%) unintentional (including 148 or 50.5% therapeutic error), 42 (14.3%) intentional (including 40 or 13.7% suspected attempted suicide), and 4 (1.4%) adverse reaction.
- Most (n=285, 97.3%) of the ingestions occurred at the patient’s own residence.
- The management site was 173 (59.0%) on site, 87 (29.7%) already at or en route to a healthcare facility, and 33 (11.3%) referred to a healthcare facility.
- Of the 120 patients seen at or referred to a healthcare facility, 58 (48.3%) were treated/evaluated and released, 13 (10.8%) admitted to a critical care unit, 16 (13.3%) admitted to a non-critical care unit, 15 (12.5%) admitted to a psychiatric facility, 4 (3.3%) refused referral, and 14 (11.7%) lost to follow-up.
- The medical outcome was 97 (33.1%) no effect, 15 (5.1%) minor effect, 19 (6.5%) moderate effect, 4 (1.4%) major effect, 16 (5.5%) not followed-judged nontoxic, 128 (43.7%) not followed-minimal clinical effects possible, 12 (4.1%) unable to follow-potentially toxic, and 2 (0.7%) unrelated effect; no deaths were reported.
- The most frequent clinical effects were tachycardia (n=18, 6.1%), drowsiness/lethargy (n=16, 5.5%), vomiting (n=8, 2.7%), hypertension (n=7, 2.4%), and nausea (n=7, 2.4%).
- The most frequent treatments were dilute/irrigate/wash (n=100, 34.1%), food/snack (n=112, 38.2%), intravenous fluids (n=37, 12.6%), and activated charcoal (n=28, 9.6%).

Conclusion
- The majority of SGLT2 inhibitor ingestions involved patients who were female and adults.
- Most ingestions were unintentional, particularly therapeutic errors.
- The majority of the ingestions were managed outside of a healthcare facility and did not result in serious health outcomes.
Euganol is the major component of clove oil and ingestions as small as 10 milliliter (mL) have been associated with severe effects such as fulminant hepatic failure, metabolic acidosis, seizure, and coma. Euganol is thought to cause acute hepatic necrosis similar to acetaminophen toxicity. N-acetylcysteine (NAC) has been used in the management of acute hepatic injury in the setting of eugenol ingestion.

Case Report
A 14-month-old male weighing 11 kilograms (kg), presented to a community children’s emergency department 45 minutes after an exploratory ingestion of 15 mL of clove oil.

The patient was started on NAC per acetaminophen ingestion institutional protocol 1 hour and 45 minutes after reported ingestion which included a loading dose of 150 milligrams (mg)/kg over 60 minutes followed by a dose of 50 mg/kg over 4 hours followed by 100 mg/kg over 16 hours.

The patient’s AST level peaked at 123 international units (IU)/liter (L) (normal range 20-60 u/L) about 14 hours after ingestion. The remainder of his laboratory studies including glucose, alanine aminotransferase (ALT), coagulation studies, and chemistry remained unremarkable. The patient was observed off of NAC for 24 hours and had repeat liver function studies without evidence of rebound and was subsequently discharged home.

Discussion
There is a case report of a 15 month old patient who ingested 10 mL of clove oil that went on to develop fulminant hepatic failure 24 hours after ingestion with an ALT peak of 13,000 IU/L. NAC was initiated afterwards. Our case is clinically similar except our patient was started on NAC early in the course of the ingestion and did not develop the degree of liver injury seen in the earlier case report.

The major limitation of this case report is that there was no oil left for testing to confirm the presence of eugenol.

H₃C
HO

Eugenol
Introduction

Prevention of snake envenomations in North America often focuses on avoiding interactions between humans and snakes. Previous methods have focused on the influence of geography, type of habitat, and time of year. Little has been described regarding a detailed analysis of weather patterns on snakebite envenomation behavior.

Time of year has also been a relatively common reported risk factor with summer being the most common time for envenomations [Seifert, Curry, Wasko]. Little has been described regarding a detailed analysis of weather patterns on snakebite envenomation behavior, but there are few studies that center around envenomations and weather. A study in Israel found an association of an increase in snakebites with higher temperatures and lower humidity as well as with heat waves during any season [Shashar]. While a Brazilian study claimed that snakebites were more likely to occur during rainy periods with higher humidity and mild temperatures [Ferreira]. It has also been described that snakes are more active and move around more at higher humidity and higher temperatures of up to 30 °C, but the data was limited to the non-venomous western ratsnake [George]. Another review showed that flooding leads to an increased incidence of snakebites [Ochoa]. While another study attempting to show an increase in snakebites after hurricanes failed to find any correlation [Schulte].

This paper seeks to fill some of the gaps with regards to envenomations and weather patterns because the more that is understood regarding snake behavior the better envenomations can be prevented.

Methodology

• This is a retrospective case crossover study of non-pregnant adults (n=489) who reported snake envenomations throughout the state of Alabama to the Alabama Poison Information Center (APIC) from January 1, 2014 - December 31, 2018.
• Inclusion criteria included non-pregnant adults greater than age 18 in years 2014-2018.
• Demographic characteristics recorded from ToxSentry included age and gender of the individual, as well as the date, time, and zip code associated with the envenomation, and the snake description were collected.
• Zip codes were only used to gather appropriate weather data from the Weather Underground historical database.

• Primary outcomes included barometric pressure (in), actual temperature (°F), high and low daily temperature (°F), and weather condition (fair, cloudy, or rain/precipitation), and were collected and compared to the same zip code, date, and time exactly one week and one year prior to the envenomation using historical data from the Weather Underground database.
• Weather conditions at one week and one year prior served as comparisons for the event of envenomation, allowing us to elicit the effect of weather patterns on occurrence of snake envenomations.
• Paired t-tests and Stuart-Maxwell tests were used to determine differences in weather conditions during the study period. A p-value < 0.05 was considered statistically significant.
• This study was IRB-approved.

Results

• The study population was:
  • 72% male
  • Highest number of envenomations having occurred in the month of July (19.6%) in between 7-8pm (12.1%).
  • Agkistradons (37.8%), Crotalids (19%), non-venomous species (4.3%), and unidentified snakes (38.9%).
• At the time of envenomation the weather was most often fair (52.2%), then cloudy (44%), and least frequently demonstrated rain/precipitation (3.9%).
• Snake envenomations increased significantly (p<0.0001) on days with a higher daily high temperature when compared days both one week and one year prior in the same zip codes at the same time of day.
• There were no statistically significant differences noted when comparing the actual temperature at the time of envenomation, daily low temperature, barometric pressure, or precipitation to dates one week and one year prior.
• There were statistical differences in the distribution of weather conditions (fair, cloudy, or rain/precipitation) on the day of envenomation compared to one week prior (p<0.0001) and one year prior (p<0.0008), supporting differences in the weather conditions at the time of envenomation compared to dates one week and one year prior. Specifically, envenomations were more likely to occur on days with “fair” weather and less likely to occur on days that were “cloudy” or “rain”.
• Limitations of this study include its retrospective nature, location in a single state in the United States, and low total number of envenomations.

Conclusions

In our single-center study, snake envenomation behavior, as it relates to easily reportable weather measurements, appears to be associated with the warmer days and the overall high temperature on the day of envenomation as well as “fair” weather. Actual temperature, low temperature, barometric pressure, and precipitation at the time of envenomation do not appear to be associated with an increased risk of envenomation in our population.
Severe Poisoning with Prunus armeniaca Toxicity in a Patient with Underlying Cardiac Disease: A Significant Risk for an Aging Population

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Older adults may require a lower referral threshold for ingestions of apricot kernels due to underlying cardiovascular disease

CASE REPORT
- 76-year-old 75kg man with a h/o CAD and one stent and hypertension consumed 20 apricot kernels blended in a smoothie as a health supplement and within several minutes developed dyspnea, lightheadedness, and myoclonic jerking. Upon arrival to the ED he was tachycardic (P-109), hypertensive (BP-195/99), and tachypneic (R-40). Initial labs:
  - Lactate 16 mmol/L
  - HCO3 16 mEq/L
  - Glucose 237mg/dL
  - ABG 7.15/25.6/226
  - Troponin I 0.01ng/mL
  - CXR Pulmonary Edema
  - EKG Anterolateral ST changes consistent with ischemia.

  Initial Treatment:
  - Hydroxocobalamin 5g IV with rapid improvement.

  Course:
  - His lactate decreased to 3 mmol/l 2hrs after hydroxocobalamin and was normal 6hrs later.
  - His troponin increased to 2.78 ng/mL and EKG changes persisted.
  - On Day 2 cardiac catheterization resulted in placement of 3 stents associated with restenosis of previous stent and additional vessel stenosis.
  - The patient was discharged on Day 3.

BACKGROUND
- Cyanide toxicity associated with ingestion of Prunus armeniaca (apricot kernels) is rarely reported though frequently encountered by poison centers, especially in older adults.
- We present a case of apricot kernel toxicity was likely exacerbated by underlying cardiovascular disease.

DISCUSSION
- Apricot kernels contain 0.5mg of cyanide per apricot kernel.
- Deaths associated with apricot kernel ingestions are rare and usually occur with dosing of 0.5-3.5mg/kg of liberated cyanide.
- Lower doses cause encephalopathy, dyspnea, lactic acidosis, hyperglycemia, hypotension, and seizures.
- Cardiac demand ischemia is not frequently reported, but was noted in our patient who ingested approximately 0.13mg/kg of cyanide via apricot kernels.
- Although specific dosing thresholds cannot be established through this single case report, toxicologists and poison specialists should maintain a lower threshold for referring older adults to EDs following ingestion of apricot kernels due to a higher prevalence of underlying cardiovascular disease.
Methods
• Data were obtained from National Electronic Injury Surveillance System (NEISS), a database of product-related injuries collected from approximately 100 US hospitals.
• National estimates are calculated from the database records based on sample weight assigned to each case based on inverse probability of hospital being selected for NEISS sample.
• Cases were records with “pod,” “pack,” or “pak” in the Narrative and product code 949 in the product code fields or mentioned in the Narrative that the product was a laundry detergent.

Background
• In 2012, laundry pods were introduced in the US.
• Shortly after, poison centers and health care providers reported associated injuries: nausea/vomiting, cough or choke, ocular irritation or pain, red eye, drowsiness or lethargy, and oral irritation.
• In Dec 2015, standards for laundry pods and packing/labeling were released to reduce exposure risk.
• The objective of this study was to describe laundry pod related injuries managed at US Emergency Departments.

Results
• 1,131 laundry pod-related injuries identified resulting in a national estimate of 31,154 injuries
• Age: 90.2% of cases were 0-5 years old
• Gender: 51.5% males vs 45.8% females
• Only 2.9% cases were reported to the Poison Center

Conclusions
• The estimated number of laundry-pod related injuries increased from 2012-2014 then declined from 2015-2018.
• Most cases were 0-5 years old.
• The majority of injuries occurred by ingestion, followed by the ocular route.
• Most cases were treated or evaluated and discharged from ED.