Capsaicin adverse events reported to the Food and Drug Administration

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Background

- Capsaicin, Capsicum pepper extract, has anti-inflammatory and analgesic properties.
- It is used as a topical medication for the management of neuralgia, neuropathy, and osteoarthritis.
- Capsaicin is a strong irritant and can cause dermal burning or stinging.
- If ingested, capsaicin can result in nausea, vomiting, abdominal pain, and diarrhea.
- Ocular exposure can cause tearing, ocular pain, and conjunctivitis.
- The objective of this study was to describe capsaicin medication adverse events reported to the United States Food and Drug Administration (FDA).

Methods

- Data were obtained from the FDA Adverse Event Reporting System (FAERS), a national database that contains reports of drug and other biologic product adverse events and medication errors.
- Reports are coded using the Medical Dictionary for Regulatory Activities (MedDRA), a validated, internationally standardized medical terminology.
- A report is classified as serious if one or more of the following outcomes were documented in the report: death, hospitalization, life-threatening, disability, congenital anomaly, and/or other serious outcome.
- The FAERS public dashboard was searched for all records added during 2000-2019 that reported capsaicin or Capsicum, and the raw data for the records were downloaded.
- Cases were all records with no substances other than capsaicin or Capsicum mentioned.
- The distribution of capsaicin adverse events was determined for various factors related to patient demographics, circumstances of the exposure, symptoms, and outcome.

Results

- A total of 505 capsaicin adverse events were identified, 240 (47.5\%) reported by a consumer, 218 (43.2\%) by a healthcare professional, and 47 (9.3\%) not specified.
- The mean age was 51.7 years (range 10-87 years).
- The patient’s sex was 306 (60.6\%) female, 153 (30.3\%) male, and 46 (9.1\%) unknown.
- The reported outcomes were 100 (19.8\%) not serious, 10 (2.0\%) required intervention, 51 (10.1\%) hospitalized, 15 (3.0\%) disabled, 7 (1.4\%) life threatening, 321 (63.6\%) other outcomes, and 43 (8.5\%) died.

Conclusion

- Capsaicin adverse events most often involved patients who were female and over 40 years.
- The product was most often used to treat neuralgia, neuropathy, arthritis, arthralgia, and myalgia.
- The most frequently reported adverse reactions were pain, burning sensation, erythema, and blisters.
- The majority of adverse events resulted in serious outcomes. However, these serious outcomes, including deaths, were not necessarily related to the capsaicin.

Public dashboard: https://fis.fda.gov/sense/app/d10be6bb-494e-4cd2-82e4-0135608ddc13/sheet/33a0f68e-845c-48e2-bc81-8141c6aaef772/state/analysis

A Textbook Presentation of Inorganic Mercury Poisoning from Skin Lightening Cream -- With Persistent Disease Despite Source Removal

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Background

• Mercury is a ubiquitous, non-essential, and toxic metal that exists in elemental, inorganic, and organic forms. Inorganic mercury salts have been used historically as antibacterials, topical antiseptics, paints, and dyes. Dermal absorption increases in lipophilic vehicles like creams.

• Herein we present a woman with subacute onset of migratory rashes, nephrotic syndrome, and neuropsychiatric symptoms attributed to inorganic mercury poisoning from chronic application of an unregulated skin lightening product.

Case Discussion

• Some skin lightening and smoothing creams have previously been found to contain dangerous levels of mercury.

• In our case, chronic use of skin lightening cream (Nunn Care Crema Limpiadora, Figure 2) caused rashes characteristic of acrodynia on treated skin, symptomatic membranous nephropathy, and an array of neuropsychiatric symptoms.

• Early chelation may have been beneficial, at the point of regional Poison Control System consultation urine mercury levels were below 50ug/L and steadily decreasing, consistent with the 40-45 day half-life of inorganic mercury. Proteinuria had also plateaued. Given this, chelation was not pursued, anticipating limited benefit to symptoms, with urine surveillance demonstrating normalization with source removal alone.

• Unfortunately, one year after exposure removal the proteinuria and migratory rashes have unexpectedly persisted.

Case Report

• A 40-year-old woman with morphea of her trunk and arms presented with three months of progressive lower extremity bilateral edema and a dynamic, painful, maculopapular desquamating rash to her face, neck, and upper extremities (Figure 1).

• Vital signs were within normal limits

• Laboratory studies revealed nephrotic-range proteinuria (8.2 g/day) and normal renal function (creatinine 1.0 mg/dL). Hemogram, metabolic panel, and urine studies were unremarkable.

• Renal biopsy revealed membranous nephropathy

• Skin biopsy revealed a neutrophilic infiltrate characteristic of hypersensitivity rash.

Figure 1: Patient Rash

Figure 2: Product Involved

Case Report, continued

• Suspicion for mercury toxicity grew when she revealed use of skin lightening cream, originating in Mexico, obtained from a well-known online retailer and applied daily over the previous year. Progressive symptoms of fatigue, insomnia, depression, irritability, insecurity, and apathy had developed over the same timeframe.

• Unspeciated urine mercury returned at >80 ug/L (normal <5 ng/mL) and whole blood mercury returned at 9 ng/mL (normal 0-9 ng/mL).

• She stopped applying the cream when it was found to have a high mercury concentration (5880mg/kg). An outside healthcare provider decided against chelation. After discontinuation of the cream, urine mercury levels became undetectable over six months.

• Proteinuria and migratory rashes persisted despite the passage of nearly one year after source removal and five months since normalization of urine mercury levels.

Conclusions

• Inorganic mercury poisoning results from dermal application of some poorly regulated skin lightening creams.

• We present a case of membranous nephropathy, subtle neuropsychiatric symptoms, and acrodynia to mercury exposed skin in an otherwise healthy adult.

• Despite removal from exposure, proteinuria and rashes persist.

• Maintain a differential diagnosis that includes chronic exposure to toxins that may hide in everyday sight.
Presumed COVID-19 Delaying the Diagnosis of Methemoglobinemia: A Case Report

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Minnesota Poison Control System | Minneapolis, Minnesota

Background

- Dapsone is a potent oxidizing agent and well known cause of intravascular hemolysis and methemoglobinemia.

Case Report

- A 34-year-old woman with systemic lupus erythematosus, lupus nephritis, and anemia of chronic kidney disease, presented to the viral clinic in the midst of the COVID-19 pandemic with one week of progressive fatigue, palpitations, and dyspnea on exertion.

- Two months prior she was treated for *Pneumocystis jiroveci* pneumonia with three weeks of atovaquone and higher-dose prednisone. This was followed by clindamycin and primaquine after G6PD screening had returned negative. She had since been on prophylactic dapsone plus her immunosuppressives prednisone and mycophenolate mofetil.

- In clinic, vital signs were within normal limits.

- She was admitted with presumed COVID-19, acute on chronic anemia, and hemolysis. Dapsone was stopped, she received multiple RBC transfusions. Her COVID-19 test returned negative.

Case Discussion

- Dapsone can cause persistent methemoglobinemia for multiple days given the long half-life of the parent compound and presence of an active metabolite.

- In this case, the assessment was clouded, and diagnosis delayed, by suspicion for COVID-19 in the setting of a global pandemic.

- It was not until COVID-19 testing returned negative that toxicology was consulted, methemoglobin levels obtained, and treatment initiated - an example of how anchoring bias can adversely affect clinical decision making.

Conclusions

- Dapsone is a well known cause of persistent intravascular hemolysis and methemoglobinemia, which in this case presented with symptoms similar to COVID-19.

- As methemoglobinemia and COVID-19 may have similar initial presentations, one must maintain a broad differential during the coronavirus pandemic to avoid anchoring bias.

<table>
<thead>
<tr>
<th>Parameter</th>
<th>Value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Hemoglobin</td>
<td>6.7 g/dL</td>
</tr>
<tr>
<td>WBC</td>
<td>3.62 K/uL</td>
</tr>
<tr>
<td>Potassium</td>
<td>6.2 mEq/L</td>
</tr>
<tr>
<td>Bicarbonate</td>
<td>20 mEq/L</td>
</tr>
<tr>
<td>Anion gap</td>
<td>9</td>
</tr>
<tr>
<td>Creatinine</td>
<td>2.13 mg/dL (~baseline)</td>
</tr>
<tr>
<td>C-reactive protein, D-dimer, transaminases, total bilirubin</td>
<td>normal</td>
</tr>
</tbody>
</table>
Atomoxetine Overdose with Neurologic and Cardiac Toxicity

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2Kansas Poison Center at the University of Kansas Health System, Kansas City, KS

Background

- Atomoxetine is a selective norepinephrine reuptake inhibitor
- Approved for treatment of attention-deficit/hyperactivity disorder (ADHD)
- Adverse events reported include neurologic and cardiovascular events with conflicting evidence of risk and severity

Case Presentation

- 30-year-old male called EMS after ingesting 5175mg of his atomoxetine in a suicide attempt
- History of bipolar schizophrenia, substance abuse, and previous suicide attempts
- This ingestion resulted in a serum atomoxetine level of 15,000 ng/mL, a QRS of 157 ms, and a QTc of 476 ms that resolved to 79 ms and 440 ms, respectively

Discussion

- A 17-year-old female with 2.84g ingestion of atomoxetine reported to have a serum level of 1995 ng/mL, and a QRS of 94 ms and QTc of 476 ms that resolved to 79 ms and 440 ms, respectively
- A 2009 study suggests atomoxetine directly blocks hERG potassium currents – does not explain QRS prolongation
- Clinicians should be aware of potential for QRS widening in large atomoxetine overdoses

References

Background

• webPOISONCONTROL® (webPC) is a free online tool with a corresponding mobile app that allows the public to determine appropriate triage and first aid recommendations for poison exposures without calling a poison center (PC).

• This retrospective analysis reviews our 2019 webPC experience.

Methods

• webPC was passively promoted through a badge at the bottom of the mnpoison.org homepage. The public can also find the tool through online searches.

• webPC visitors were directed to contact a PC if exposures were polysubstance or if the exposed individual was not between 6 months and 79 years of age, had any serious pre-existing medical conditions, reported pregnancy, or involved self-harm.

• Descriptive statistics were used (see tables).

• We attempted to match all webPC cases over one month to a corresponding case in ToxiCALL®, the PC's electronic medical record system, to analyze adherence to triage recommendations.

• Matching was conducted by searching for date, approximate time of exposure, patient age and gender, zip code, exposure route, and substance corresponding to webPC cases.

Results

• A total of 2907 webPC cases were recorded for Minnesota in 2019, an increase from 732 and 2299 cases in 2017 and 2018, respectively.

• Cases originated from 85 of 97 (97.7%) counties in the state, indicating a wide reach.

• Ingestion accounted for 83.2% of exposures.

• Exposures involved non-pharmaceutical substances in 57.3% of cases, while 42.7% were pharmaceutical-related.

• Outcome data for cases referred to call a PC or go to an ED were limited due to incomplete follow-up.

• Over one month, 51.5% of users directed to call the PC were matched to ToxiCALL® cases. Moreover, two (66.7%) users directed to the ED and one (6.3%) users triaged to stay home called the PC for further advice or reassurance (Table 5).

• Limitations with matching included potential misrouting of PC calls to another regional PC and the inability to confirm a match's accuracy. Users also may have gone directly to the ED without calling a PC.

Conclusions

• Passive website promotion by our PC was associated with increasing use of webPOISONCONTROL® throughout the state.

• A majority of users were kept at home and several were found to call their local PC for additional guidance or reassurance.

Jennifer Plumb1,2, McCall Christensen1,2 J Samuel Plumb2, Corey Davis3, Jacob Zimmerl1,2

1University of Utah Department of Pediatrics, SLC, UT 2Utah Naloxone 3Network for Public Health Law

Background
- Overdose is the leading cause of injury death in the U.S. and in this state which is has been as high as 4th in the nation for overdose deaths.
- Toxicologic ingestions are common in children and opioids are among the most dangerous ingestions.
- Recent national data showed that pediatric hospitalizations for opioid poisonings nearly doubled from 1997-2012.

Objective
- To describe the characteristics of children seen for opioid-related events or conditions in the Emergency Departments (EDs) of a large U.S. health care system.

Results
- 532 patients were identified by ICD codes and 52% (277) of those were confirmed by chart review as experiencing an opioid-related event.
- The age distribution is bimodal, 31% 0-5 yrs, 63% 13-18 yrs. 59% were female.
- 90% of exposures occurred in the home with less than 1% occurring in school settings.
  - Only two exposures seen at one school in a singular event where no naloxone was required.
- Events were concentrated in the urban and suburban population center.
- For medication exposures, 82% of substances were not the patient’s, 62% belonged to a parent/sibling and 13% other family.
- In 39%, the exposure was a self-harm attempt.
- Naloxone was administered en route to or while in the ED in 25%.
- 17% were admitted for behavioral health treatment and 32% were hospitalized for medical stabilization.
  - 31% of those admitted to a medical service required ICU-level care.
- There were 0 fatalities.
- 72 (26%) patients presented requiring detoxification, recovery treatment, and/or opioid withdrawal symptoms.
- All of these were 14-18 yrs and 61% were discharged from the ED without placement in detox or in a treatment setting. Of these, one patient was placed on buprenorphine in the ED.

<table>
<thead>
<tr>
<th>Substance</th>
<th>0-18 YEARS (277)</th>
<th>0-5 Years (66)</th>
<th>13-18 YEARS (174)</th>
</tr>
</thead>
<tbody>
<tr>
<td>hydromorphone</td>
<td>26%</td>
<td>10%</td>
<td>33%</td>
</tr>
<tr>
<td>oxycodone</td>
<td>25%</td>
<td>22%</td>
<td>26%</td>
</tr>
<tr>
<td>heroin</td>
<td>12%</td>
<td>0%</td>
<td>18%</td>
</tr>
<tr>
<td>buprenorphine</td>
<td>14%</td>
<td>36%</td>
<td>3%</td>
</tr>
<tr>
<td>tramadol</td>
<td>10%</td>
<td>13%</td>
<td>8%</td>
</tr>
<tr>
<td>unknown opioid</td>
<td>3%</td>
<td>1%</td>
<td>3%</td>
</tr>
<tr>
<td>codeine</td>
<td>4%</td>
<td>3%</td>
<td>3%</td>
</tr>
<tr>
<td>methadone</td>
<td>3%</td>
<td>6%</td>
<td>2%</td>
</tr>
<tr>
<td>morphine</td>
<td>2%</td>
<td>5%</td>
<td>1%</td>
</tr>
<tr>
<td>hydromorphone</td>
<td>1%</td>
<td>1%</td>
<td>1%</td>
</tr>
<tr>
<td>oxymorphone</td>
<td>1%</td>
<td>2%</td>
<td>0%</td>
</tr>
<tr>
<td>fentanyl</td>
<td>0%</td>
<td>0%</td>
<td>1%</td>
</tr>
</tbody>
</table>

Conclusions
- Children with opioid related ED visits in this single large healthcare system had a bimodal age distribution, mostly ingested medications belonging to family members, and 49% were admitted for further medical or behavioral health care.
- These results support redirecting anticipatory guidance to include screening for opioids in the home, education on the risks of opioid exposure in children, and access to naloxone rescue kits in homes with opioids and children present.
- Increased access to detox and/or recovery services are also needed.
- Further evaluation of how current overdose prevention and treatment access strategies can target those at risk is necessary.
# Naloxone Rescue Kits and Syringe Exchange Services: People Who Use Drugs Are Life Savers

Jennifer Plumb\(^1\,^2\) Jacob Zimmerli\(^1\,^2\) J Samuel Plumb\(^2\) Erin Fratto\(^1\,^2\) Emily Parker\(^3\) Melynda Vincent\(^4\) McCall Christensen\(^1\,^2\)

\(^1\)University of Utah Department of Pediatrics, SLC, UT \(^2\)Utah Naloxone \(^3\)One Voice Recovery \(^4\)Utah Harm Reduction Coalition

## Background
- Poisoning/overdose is the leading cause of injury death in the United States as well as in this state which has been as high as 4% in the nation for overdose deaths.
- One response strategy that has been implemented in many states and communities has been increased community member access to the opiate antagonist naloxone.
- Since equipping laypersons with naloxone rescue kits began over two decades ago, non-medical community members have saved thousands of lives nationwide.
- One of the most successful access points for placement of these kits has been in the setting of syringe exchange.
- Partnerships that place naloxone directly in the hands of people who use drugs have demonstrated crucial strides in preventing preventable deaths, and give us frontline information about appropriate naloxone dosing for those using the substances we often know the least about.

## Objective
- To describe the reported use of IM (intramuscular) injectable naloxone rescue kits (containing 0.4 mg/ml naloxone doses) within a population of layperson participants in syringe exchange services programs (SES).

## Design/Methods
- Naloxone rescue kits were provided to participants in SES, each kit containing 2 doses of 0.4 mg naloxone vials and 2 syringes with attached needles.
- Participants in SES were encouraged to obtain multiple kits if desired.
- Participants were trained by SES staff on overdose recognition and naloxone administration.
- Anonymous self-reporting of naloxone rescue kit use including: the number of 0.4 mg naloxone doses/vials used in an opioid overdose reversal, who it was used on, if EMS was called, and if the individual survived.
- Reversal data was collected anonymously by staff members of each SES and aggregated by the lead agency.

## Results
- 2,405 individual reports of naloxone rescue kit use were documented over 39 months (02/17-05/20). Data points were obtained on 673 of these reversals.
- Rescue kits were furnished by one central agency to 5 community-based partner organizations (CBOs), and were provided to participants during SES outreach services.
- 81% (660) of the reports described a successful reversal and survival.
- The reported use was on a friend/acquaintance (69%), self (10%), stranger (9%), family member (5%), spouse (1%), or unknown (6%).
- The number of 0.4 mg naloxone doses used:
  - 1 dose of naloxone in 28% (187)
  - 2 doses 54% (362)
  - 3 doses 11% (71)
  - 4 doses 4% (28)
  - 5+ doses 2% (13)
- There were 13 unsuccessful reversal reports (2%) during this time period using between 1-4 vials of naloxone.
- EMS was called 40% (268) of the time when a layperson rescue kit was used in this setting.

## Conclusions
- Individuals participating in syringe exchange services programs self-reported the use of naloxone rescue kits that had been furnished to them.
- 98% of those receiving layperson naloxone in this setting were reported to have survived.
- The majority of the reversals reported were on a friend/acquaintance, but were also on family members, the participants themselves, and even on strangers.
- Over 82% of the reversals were reported successful with 1 or 2 doses of 0.4 mg IM injectable naloxone.
- There is no indication from these results that an increased dose of naloxone is required or needed in general for each rescue kit for equipping laypersons.
- These results do suggest that individuals in the SES setting should have access to multiple kits or kits with at least 3-4 doses given that 60% of the reports did not include a call to EMS.
- Increased education about the role of EMS as well as ensuring individuals in this setting have access to multiple kits/doses is recommended.
- People who use drugs are saving the lives of those around them.
BACKGROUND

Lamp oil and related products, such as citronella and tiki-torch fuels, are hydrocarbon or petroleum-based products.

- Inhalation or aspiration of lamp oil may result in cough, vomiting, nausea, fever, drowsiness, dyspnea, hyperventilation, erythema, pneumonia, and respiratory distress.
- Deaths have been reported.

Young children may be attracted by the lamp oil’s color or by its fragrance.

- Furthermore, lamp oil may be stored in containers that children may easily open or in the product for which the fuel is intended (e.g., lamp, torch) and left within reach of children.

This study describes pediatric lamp oil exposures reported to poison centers.

METHODS

Data source: Texas Poison Center Network (statewide system of 6 poison centers that covers entire state, population of >25 million)

Cases: Exposures among young children to lamp oil reported during 2000-2018
- Patient age 0-5 years
- Substance assigned Poisindex Generic 0201031 (Lamp oil)
- Included exposures involving more than one substance
- Includes exposures not followed to a final medical outcome

Analyses: Case distribution was determined for factors related to patient demographics, exposure circumstances, management, and outcome.

RESULTS

Total pediatric lamp oil exposures: 2,310
Annual number of exposures declined from 205 in 2000 to 44 in 2018

Figure 1. Lamp oil exposures among patients age 0-5 years reported to the Texas Poison Center Network, 2000-2018, by patient age

Table 1: Patient age (years)

<table>
<thead>
<tr>
<th>Patient age (years)</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-1</td>
<td>7.0</td>
</tr>
<tr>
<td>2</td>
<td>8.2</td>
</tr>
<tr>
<td>3</td>
<td>3.2</td>
</tr>
<tr>
<td>4</td>
<td>1.6</td>
</tr>
<tr>
<td>5</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Figure 2. Lamp oil exposures among patients age 0-5 years reported to the Texas Poison Center Network, 2000-2018, by patient sex

Table 2: Patient sex

<table>
<thead>
<tr>
<th>Patient sex</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male</td>
<td>60.1</td>
</tr>
<tr>
<td>Female</td>
<td>39.6</td>
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<tr>
<td>Unknown</td>
<td>0.3</td>
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</table>

Figure 3. Lamp oil exposures among patients age 0-5 years reported to the Texas Poison Center Network, 2000-2018, by exposure route

Table 3: Route

<table>
<thead>
<tr>
<th>Route</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Ingestion</td>
<td>94.4</td>
</tr>
<tr>
<td>Dermal</td>
<td>10.6</td>
</tr>
<tr>
<td>Aspiration</td>
<td>0.6</td>
</tr>
<tr>
<td>Ocular</td>
<td>0.2</td>
</tr>
<tr>
<td>Inhalation</td>
<td>0.1</td>
</tr>
<tr>
<td>Otic</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Figure 4. Lamp oil exposures among patients age 0-5 years reported to the Texas Poison Center Network, 2000-2018, by exposure reason

Table 4: Reason

<table>
<thead>
<tr>
<th>Reason</th>
<th>Percent</th>
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</thead>
<tbody>
<tr>
<td>Unrelated</td>
<td>29.6</td>
</tr>
<tr>
<td>Intentional</td>
<td>0.2</td>
</tr>
<tr>
<td>Adverse reaction</td>
<td>0.1</td>
</tr>
<tr>
<td>Other, unknown</td>
<td>0.1</td>
</tr>
</tbody>
</table>

Figure 5. Lamp oil exposures among patients age 0-5 years reported to the Texas Poison Center Network, 2000-2018, by exposure site

Table 5: Exposure site

<table>
<thead>
<tr>
<th>Exposure site</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Own residence</td>
<td>92.4</td>
</tr>
<tr>
<td>Another residence</td>
<td>5.9</td>
</tr>
<tr>
<td>Public area</td>
<td>0.6</td>
</tr>
<tr>
<td>School</td>
<td>0.2</td>
</tr>
<tr>
<td>Other, unknown</td>
<td>0.9</td>
</tr>
</tbody>
</table>

Figure 6. Lamp oil exposures among patients age 0-5 years reported to the Texas Poison Center Network, 2000-2018, by management site

Table 6: Management site

<table>
<thead>
<tr>
<th>Management site</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>HCF</td>
<td>56.1</td>
</tr>
<tr>
<td>At/en route to HCF</td>
<td>28.5</td>
</tr>
<tr>
<td>Referred to HCF</td>
<td>14.8</td>
</tr>
<tr>
<td>Other, unknown</td>
<td>0.5</td>
</tr>
</tbody>
</table>

Figure 7. Lamp oil exposures among patients age 0-5 years reported to the Texas Poison Center Network, 2000-2018, by medical outcome

Table 7: Medical outcome

<table>
<thead>
<tr>
<th>Medical outcome</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>own residence</td>
<td>34.4</td>
</tr>
<tr>
<td>Another residence</td>
<td>13.1</td>
</tr>
<tr>
<td>Public area</td>
<td>7.4</td>
</tr>
<tr>
<td>School</td>
<td>6.8</td>
</tr>
<tr>
<td>Other, unknown</td>
<td>3.5</td>
</tr>
<tr>
<td>Unrelated</td>
<td>3.2</td>
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</tbody>
</table>

Figure 8. Lamp oil exposures among patients age 0-5 years reported to the Texas Poison Center Network, 2000-2018, by most common clinical effects

Table 8: Clinical effect

<table>
<thead>
<tr>
<th>Clinical effect</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cough, choke</td>
<td>7.0</td>
</tr>
<tr>
<td>Vomiting</td>
<td>47.6</td>
</tr>
<tr>
<td>Fever, hyperthermia</td>
<td>32.0</td>
</tr>
<tr>
<td>Hyperventilation, tachypnea</td>
<td>0.2</td>
</tr>
<tr>
<td>Drowsiness, lethargy</td>
<td>0.4</td>
</tr>
<tr>
<td>Positive X-ray findings</td>
<td>0.4</td>
</tr>
</tbody>
</table>

Figure 9. Lamp oil exposures among patients age 0-5 years reported to the Texas Poison Center Network, 2000-2018, by most common treatments

Table 9: Treatment

<table>
<thead>
<tr>
<th>Treatment</th>
<th>Percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>Oxygen</td>
<td>62.9</td>
</tr>
<tr>
<td>Inhalation</td>
<td>7.9</td>
</tr>
<tr>
<td>Food, snack</td>
<td>6.1</td>
</tr>
<tr>
<td>Dilute, irrigate, wash</td>
<td>5.3</td>
</tr>
</tbody>
</table>

CONCLUSIONS

Lamp oil exposures among patients age 0-5 years
- Declined during 2000-2018
- Most patients were male
- Most patients were age 0-2 years
- Majority were unintentional
- Most occurred at home
- Most managed outside of a healthcare facility
- Most exposures resulted in outcomes that were not serious
Cannabis is the most widely used illicit agent in the United States. Rates of cannabis use disorders, such as cannabinoid hyperemesis syndrome (CHS), are on the rise. CHS has rarely been associated with serious permanent adverse sequelae. This case report details CHS contributing to development of Wernicke’s encephalopathy (WE).

**Background**

Cannabis is the most widely used illicit agent in the United States. Rates of cannabis use disorders, such as cannabinoid hyperemesis syndrome (CHS), are on the rise. CHS has rarely been associated with serious permanent adverse sequelae. This case report details CHS contributing to development of Wernicke’s encephalopathy (WE).

**Case Presentation – ED Course**

**ED Course:** A 25-year-old female with prior history of CHS presented to the ED complaining of three months of vomiting with acute complaint of confusion. This was her eighth ED visit in three months with a reported 30-pound weight loss in that timeframe. The patient had normal vital signs, with neurologic findings including nystagmus, disorientation, and gait instability. Lab tests were notable for hypokalemia (2.7 mmol/L), hypophosphatemia (2.6 mg/dL), and elevated lactate (4.5mmol/dL). Urine drug screen was positive for tetrahydrocannabinol. Lumbar puncture studies were normal. The patient received intravenous fluids, electrolyte repletion and high dose thiamine. Magnetic resonance brain imaging revealed abnormal signal within the periaqueductal coronal gray matter and mamillary bodies consistent with WE.

**Case Presentation – Inpatient Course**

**Inpatient Course:** The patient was admitted for high dose thiamine, nutritional supplementation, and psychiatric treatment. The vomiting attributed to CHS improved by hospital day 13. In addition to CHS, the patient was diagnosed with avoidant and restrictive food intake disorder secondary to fear of swallowing spurred by a remote choking event. She required a percutaneous endoscopic gastrostomy for nutritional support. The patient was discharged on hospital day 25 with ongoing cognitive dysfunction and gait instability.

**Discussion**

WE is a rare, but serious complication of malnourishment. This case report highlights CHS as a possible contributing factor in the development of WE. Awareness of this complication is important to treat preventable sequelae of nutritional deficiencies in patients with CHS.

**Figures**

**Fig 1:** Increased T2 FLARE signal at mamillary bodies.

**Fig 2:** T1 coronal slice.

**References:**


Lactic Acidosis after Inadvertent Intravenous Administration of Oral Liquid Acetaminophen Containing Propylene Glycol Diluent

Daniel L Overbeek, MD\(^1\); Katherine L Boyle, MD\(^{1,2}\)

\(^{1}\)Harvard Medical Toxicology Program, Boston Children’s Hospital, Boston, MA \(^{2}\)Department of Emergency Medicine, Beth Israel Deaconess, Boston, MA

### Background

- Propylene glycol is a common diluent in oral preparations of many medications
- Intravenous (IV) bolus propylene glycol exposures are uncommon, where prolonged low dose infusions have been previously described

### Case Report

- 61 year old female patient with a history of chronic gastrointestinal issues, percutaneous gastric tube and indwelling intravenous (IV) central line
- Oral acetaminophen liquid was ordered and inadvertently administered via the IV line
- Hypotension with profound dizziness followed, requiring IV crystalloid resuscitation and norepinephrine infusion
- Lactic acid peaked at 7.7 mmol/L
- Sepsis secondary to administration of non-sterile solution was considered, but infectious workup including blood cultures negative
- Hemodynamics improved and symptoms resolved over the following 24-48 hours
- Based on concentration provided by manufacturer (Major Pharmaceuticals), the patient received 4.67g of propylene glycol

### Propylene Glycol

- Propylene glycol is metabolized by hepatic alcohol dehydrogenase to lactic acid
- Toxicity has been seen in cases with prolonged infusion of drugs using propylene glycol as a diluent, with lactic acidosis, shock and hypotension
- Management includes aggressive supportive care, and propylene glycol and lactic acid can be dialyzed in severe cases

### Conclusions

- Inadvertent intravenous medication administration can have multiple consequences including toxicity from substances generally safe when taken orally
- This case demonstrated myocardial suppression and lactic acidosis after an intravenous dose of 4.67g of propylene glycol, resolving with vasopressor support
Intentional Suspected Suicide Exposures by Poisoning Among Adolescents from 2009-2018 Reported to a Regional Poison Center and Compared Nationally

Britni Overall, CHES1, Stephanie L. Hon, PharmD, DABAT1, Alison Jones, MSHA, MBA1, Tim P. Moran, PhD2, Kevin Hunt, PhD3

1Georgia Poison Center, Atlanta, GA; 2Emory University, Department of Emergency Medicine, Atlanta, GA; 3Georgia College & State University, Milledgeville, GA

Background

- The rise in suicide and suicide attempts among adolescents is a major public health issue.
- Suicide is the second leading cause of death for individuals between the ages of 10-34 in the United States.
- Poisoning is a common method of self-harm and death among adolescents, it ranks as the third most common method used in suicide deaths in the United States.

Objective

- This study aimed to report the incidence and characteristics of intentional suspected suicide exposures involving 13-19 year olds over a ten-year period reported to a regional poison center and compared nationally.

Methods

- A retrospective chart review of intentional suspected suicide cases reported to a regional poison center from 2009 to 2018 for patients 13-19 years old.
- For comparison, data from the National Poisoning Data System (NPDS) was obtained.
- Cases coded as “unrelated effect” and “confirmed non-exposure” were excluded.
- Changes in the incidence rate and characteristics by patient age and gender were evaluated.

Conclusions

- More than half (66.5%) of the cases involved only one substance.
- Pharmaceuticals made up 94.5% of the substances used with analgesics accounting for 42.1%, followed by antidepressants at 20.8%.
- A significant difference was found in substances used among males and females (p < .001).
  - Females were more likely to use:
    - analgesics (45.17% vs. 32.90%)
    - supplements/vitamins/hormones/herbals/minerals/electrolytes (4.86% vs. 2.91%)
  - Males were more likely to use:
    - alcohol/ethanol (3.50% vs. 1.97%)
    - arts/crafts/office supplies (0.18% vs. 0.02%)
    - household cleaning substances (4.77% vs. 2.56%)
    - marijuana (1.15% vs. 0.27%)
    - pesticides/outdoor chemicals (0.71% vs. 0.14%)
    - plants/mushrooms (0.32% vs. 0.03%)
    - sedatives/hypnotics/antipsychotics (20.45% vs. 13.58%)
    - stimulants/street drugs (6.87% vs. 4.12%)
- As compared to similar teen data reported by other US poison centers, the regional poison center was more likely to have more patients admitted to critical care and a psychiatric care facility, and fewer patients with major and moderate effects. And while most of the regional poison center patients were female, they had a larger proportion of male patients than other US poison centers (p < .001).
Benzodiazepine and Opioid Toxicity Treated with Simultaneous Flumazenil and Naloxone Infusions

Nkiru Osude MD, Claudine Feliciano DO, Saifeer Shah MD, Ejaaz Kalimullah MD, Christina Hantsch MD
Loyola University Medical Center

BACKGROUND

Flumazenil and naloxone are FDA-approved for the reversal of opioid and benzodiazepine toxicity, respectively. Flumazenil antidote therapy is infrequently utilized in benzodiazepine overdose due to the risk of precipitating seizures in select populations. We present a case of combined benzodiazepine and opioid overdose in which concurrent flumazenil and naloxone infusions prevented the need for mechanical ventilation. Use of this combination has not previously been reported.

CASE REPORT

A 48 year-old-male with sleep apnea and no prior benzodiazepine use presented to the emergency department (ED) after an intentional overdose of 120 mg of clonazepam, 75 mg hydrocodone, and 4875 mg acetaminophen. Upon presentation he had a Glasgow Coma Scale (GCS) of 14. Initial vitals were T 97.6°F, BP 106/79, P 79, RR 12, SpO2 95% on 3 L O2 by nasal cannula and pupils were 1 mm. Initial urine drug screen (UDS) detected only opiates. Acetaminophen concentration was 23 µg/mL. After seven hours, his condition worsened to a GCS of 6, bradypnea with RR 6 and hypoxemia (SpO2 85% on R1). Naloxone 0.4 mg was given without response. Flumazenil 0.1 mg was later given. The patient began to yawn; his RR increased to above 10 and his oxygen saturation improved. Flumazenil infusion of 0.1 mg/h was started to maintain RR above ten and SpO2 above 90%. Naloxone 1 mg was administered two hours after the flumazenil infusion with continued improvement in mental status to GCS 10 and RR of 12. Naloxone infusion was initiated at 1 mg/h. A UDS sent 36 hours later detected benzodiazepines and opiates. Attempts to decrease naloxone after 12 hours, and flumazenil on the third, fourth, and fifth day after initiation were each unsuccessful as the patient redeveloped CNS/respiratory depression. Due to the inability to discontinue antidote therapy, a daily UDS and quantitative clonazepam serum concentrations (resulted after discharge, see Table 1) were obtained. Naloxone was discontinued on day five when opiates were no longer detected on UDS. Flumazenil was discontinued on day seven without redevelopement of CNS or respiratory depression, despite persistent benzodiazepine detection on UDS.

<table>
<thead>
<tr>
<th>Day of Admission</th>
<th>Clonazepam Concentration</th>
<th>7-Aminoclonazepam</th>
<th>Flumazenil Infusion</th>
<th>Naloxone Infusion</th>
</tr>
</thead>
<tbody>
<tr>
<td>4</td>
<td>77.9 ng/ml</td>
<td>56.2 ng/ml</td>
<td>On</td>
<td>On</td>
</tr>
<tr>
<td>5</td>
<td>54.6 ng/ml</td>
<td>43.6 ng/ml</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>6</td>
<td>35.2 ng/ml</td>
<td>31.3 ng/ml</td>
<td>On</td>
<td>Off</td>
</tr>
<tr>
<td>7</td>
<td>26.0 ng/ml</td>
<td>21.4 ng/ml</td>
<td>Off</td>
<td>Off</td>
</tr>
</tbody>
</table>

Table 1: Serum Concentrations of Clonazepam and 7-Aminoclonazepam.

CONCLUSION

Use of flumazenil antidote therapy versus supportive management, including mechanical ventilation if needed, for benzodiazepine toxicity is uncommon and controversial. Hesitancy about flumazenil as antidote therapy is due to the risk of seizures especially with benzodiazepine dependence, seizure disorder, and/or coexisting tricyclic antidepressant toxicity. While naloxone (bolus and/or infusion) antidote therapy is not uncommon, we are unaware of any case reports of concurrent infusions of these medications. In this case, with appropriate patient selection, close monitoring, and targeted endpoints, flumazenil and naloxone infusions were utilized safely in combination for an extended duration.

This is the first case report of the use of concurrent flumazenil and naloxone infusions as antidotal therapy for combined benzodiazepine and opioid toxicity. Further investigation of similar antidote therapy may be warranted for suitable overdose patients, given the potential morbidity and mortality associated with prolonged mechanical ventilation.
Self-administered 300 mg iron sucrose (4.4 mg/kg) IV
Rapid onset vomiting and near-syncope
Diaphoretic and pale
Serum iron > 2000 mcg/dL
Blood pH 7.31 (normal lactate)
BP 83/51 mmHg
Serum bicarbonate 15 mEq/L

44-year-old woman, 67 kg
@ 3 hours
@ 6 hours
Treated with IV crystalloid, plus
Deferoxamine (1000mg IM, then 500mg q6hrs X 5 doses)
Her clinical condition improved rapidly

More Iron Levels:
534 mcg/dL (15 hrs), 429 mcg/dL (24 hrs), 379 mcg/dL (60 hrs)

SERUM IRON CONCENTRATION AFTER IV IRON SUCROSE ADMINISTRATION SHOULD NOT BE JUDGED IN THE CONTEXT OF HISTORICAL ORAL IRON SALT OVERDOSE RECOMMENDATIONS

Background
Iron overdose is a notorious poisoning syndrome:
- Most clinical guidance refers to oral overdose
- Many IV formulations of iron-carbohydrate complexes exist on US market
- Toxicokinetics and toxicodynamics of IV iron compounds may be variable
Risk assessment and medical response to overdose of IV iron-carbohydrate complexes warrants further characterization.

We describe a clinical case of IV iron sucrose overdose with high serum iron concentration and concerning symptoms.

Methods
Observational description of a single case.

Cause of symptoms?
It is not clear if initial symptoms were due to hypersensitivity, direct iron toxicity, or other etiology.

Chelation was administered in this case.
Indications for chelation therapy after IV iron sucrose overdose warrants further elucidation.

In a PK study involving healthy adults, IV iron sucrose at 100mg had a mean maximum serum iron concentration of 538 mcmol/L (3,000 mcg/dL).
Diagnosis of Pediatric Fentanyl Poisoning Confounded by Suboptimal Urine Drug Screening and by Medical Fentanyl Administration

Kevin C Osterhoudt, Brian Singh, Christopher Teng, Osvaldo Mercado, Philip Scribano, and Fred Henretig
The Poison Control Center, Central Lab Services, Pediatric Residency Program, and Child Protection Team at Children's Hospital of Philadelphia

Background

Fentanyl has become the predominant opioid in the opioid epidemic.

Despite increasing rates of opioid use, research shows that rates of opiate-positive drugs screens are going down.

Sub-optimal urine drug screening for fentanyl may lead to challenges in identifying opioid-poisoned young children.

We present two cases of pediatric fentanyl poisoning in which:

- suboptimal initial urine drug screening, and
- subsequent medical use of fentanyl resulted in practical diagnostic challenges!

Children remain tragic victims of the opioid epidemic.

Many hospital urine drug screens miss fentanyl.

Therapeutic use of fentanyl may confound diagnosis of fentanyl poisoning if appropriate tests aren't collected early.

Case 1
- A 2-year-old boy was found unresponsive. Midazolam and succinylcholine were given to facilitate endotracheal intubation. The hospital's commercial immunoassay subsequently was positive for benzodiazepine and negative for opiates. Brain CT demonstrated brainstem edema, the child was transferred to a tertiary-care children's hospital for emergent surgical brain decompression with propofol and inhaled anesthetic, and fentanyl and midazolam infusions were used post-operatively. A GC/MS analysis of a new urine sample was positive only for midazolam and fentanyl, which had been given medically, leading clinicians to deduce that the child did not have a toxicological diagnosis.

An early urine sample was retrieved from the referring hospital; LC/MS/MS testing found fentanyl (39 ng/mL), and norfentanyl (>1000 ng/mL) confirming fentanyl as the cause of illness.

Case 2
- An 11-month-old boy became unresponsive after being seen holding a bag of “white powder.” In a community ED he had GCS=7, T 29°C, and care providers had concern for seizure. He was given a paralytic and lorazepam and was endotracheally intubated. The hospital's commercial urine immunoassay for drugs of abuse was negative for opiates. Intravenous midazolam and fentanyl were given for sedation during transport to a tertiary care children's hospital. LC/MS/MS testing of a new urine sample at the receiving hospital found fentanyl, fentanyl metabolites, tramadol, and norfentanyl (>1000 ng/mL) confirming fentanyl as the cause of illness.

Recognize ischemic injury from opioids.

Know the limitations of your toxicology testing!

Get appropriate samples early.
Marijuana Exposure of Young Children in PA & DE as Reported to PA Poison Centers, July 2014-June 2019

Alden Dewey, Amanda Korenoski, Kevin C Osterhoudt
Philadelphia College of Osteopathic Medicine, Pittsburgh Poison Center, The Poison Control Center at Children’s Hospital Philadelphia

Background
- Children are a vulnerable group for exploratory marijuana ingestion or environmental marijuana exposure
- Evolving societal attitudes toward marijuana, and evolving state decriminalization and legalization of marijuana, has impacted its availability

Methods
- Retrospective analysis of prospectively collected NPDS cohort
- Study period: July 1, 2014 to June 30, 2019
  - Inclusion Criteria:
    - NPDS generic code 0083000, 0310121, 0310096, 0310124, 0310122, 0310126, 0310125, 0310123, 0200617
    - Children ≤ 6 years old
    - PA & DE cases reported to Pennsylvania Poison Control Centers
    - Phyrogenic sources only
  - Demographics, advanced therapies, and outcomes abstracted

Research Question
- What is the epidemiology of pediatric marijuana exposure in PA and DE as reported to poison control centers?

Results

Cases of children ≤ 6-years-old exposed to marijuana increased 575% in 5 years
63% of cases involved children less than 2 years of age
15% hospitalized in ICU setting
2 children placed on ventilators due to CNS depression, seizures and hypotension
(2020 looks like it will be more than ever)

Relevant State Law:
- 10/2014 - possession of <30g decriminalized in Philadelphia
- 12/2015 - possession of <30g decriminalized in Delaware
- DE allowed medical marijuana in 2011, PA in 2016

The protection of young children may be an important consideration in health policy decision-making related to marijuana.
Phencyclidine (PCP) Exposure Cases Among Young Children Reported to Five U.S. Statewide Poison Control Center Systems, 2009-2018

Hilary Gray, Cherie Obilom, Craig Smollin, Alexa Camarena-Michel, Diane Calello, and Kevin C Osterhoudt
Philadelphia College of Osteopathic Medicine, UT Southwestern Medical Center, California Poison Control System, Rocky Mountain Poison and Drug Safety, New Jersey Poison Information & Education System, and The Poison Control Center at Children's Hospital of Philadelphia

Drug use in child environments puts children at risk of injury!

PCP Exposure Pathways in Infants
- passive smoke inhalation
- ingestion of powder or soluble forms

We examined patient-level data to better characterize the epidemiology of PCP exposures among young children.

PCP exposures in young children are rarely reported

SOMNOLENCE / COMA - 40%
SEIZURES - 29%
NYSTAGMUS - 21%
BLANK STARE - 21%
FEVER - 19%

Choreoathetosis?
uncommon in this data

...Case reports from the 1970s:
- choreoathetosis > 50% child cases
- symptoms up to 200 hours

Exposure Reason
Most "unintentional - general"
Most in own home

Methods
Retrospective NPDS cohort of phencyclhexylpeperidine exposures (AAPCC generic code 0071000)
- Age 2 months through 5 years
- 5 statewide poison centers
- Ten year period: 2009-2018

Results:
64 records (38% of national sample) retrieved from 5 states.
Bias in Data
13 miscoded by exposure, 2 miscoded by age
5 false-positive drug tests
2 no true exposure
42 subjects eligible for study
State Contributions
TX - 19, CA - 8, PA - 7, NV - 5, NJ - 3
Demographics
Age range 2 months to 5 years
62% male
Scope of Illness
55% "moderate to severe" toxicity
4 endotracheally intubated
8 hospitalized > 3 days
No fatal cases
Exposure Reason
Most "unintentional - general"
Most in own home

Serum Quantitation in 3 Patients
- 27, >250, 325 ng/mL

Choreoathetosis? uncommon in this data

20% of records in this NPDS dataset were miscoded.

Previous work: Gray H et al. "Phencyclidine (PCP) Exposures Among Young Children Reported to U.S. Poison Control Centers: 2009 - 2018" was reported at 2020 Pediatric Academic Societies Meeting.
Qualitative Tricyclic Antidepressant (TCA) Serum Testing in an Urban Children's Hospital Has Sad Value

Zoe Bouchelle, Derick Lim, Tracey Polsky, Kevin C Osterhoudt
Pediatric Residency Program, Clinical Chemistry Laboratory & The Poison Control Center at Children’s Hospital of Philadelphia

Background
TCAs are feared for their cardiovascular and neurological toxicity.

Our hospital packages a qualitative TCA test into a "serum drug screen."

-TCA Poisoning
- Has an identifiable toxidrome
- Immunoassay has false positives

Methods
Urban, academic, tertiary care children's hospital
Lab records of TCA tests performed 2018-2019
Retrospective cohort of test results and impact

Results:
1,174 tests over 2 years
79% ordered from ED, 12% from ICU
7 positive tests
0.6% [95% CI 0.3-1%]
4 true positive tests
0.3% [95% CI 0.1-0.9%]
Age range of true positives 9-16 years
False positives were cyclobenzaprine, diphenhydramine and quetiapine.

Medical Evaluation of 4 True Positive Cases
- all had known access to TCAs
- ingestion was voluntarily disclosed by 2
- care team considered TCA poisoning in all
- no changes in care due to TCA testing documented

Limitations
Generalizability limited with data from single center.
False negative rate could not be calculated (total number of TCA poisoned patients was unknown).

TCA Testing:
Low incidence of positivity
High false-positive rate
Did not alter care

The cost-benefit of routine serum TCA screening in our clinical environment warrants critical analysis!
**Introduction**

Over 1.5 million new cancers are found in the United States annually, with an increasing number of patients favoring outpatient oral chemotherapeutic treatment when available.

As a result, an increasing number of oral chemotherapeutics may be available to Americans suffering a mental health crisis. Some of these agents have antidotes that are lifesaving when administered promptly.

We report the case of a 48-year-old female who overdosed on her home chemotherapeutic where antidote administration was delayed.

**Case**

A 48-year-old female with a history of colon cancer presented to the emergency department (ED) 1 hour after taking fifteen tablets of her oral capecitabine with vodka in a suicide attempt.

The patient reported one episode of vomiting at home 30 minutes prior to arrival. In the ED, she complained of nausea only. Her vital signs were heart rate of 83 beats per minute, blood pressure of 147/99 mmHg, respiratory rate of 20 breaths per minute, oxygen saturation of 98% on room air, and temperature of 36.9 degrees Celsius. Her exam was otherwise unremarkable. Her serum ethanol level was 0.280g/dL. Complete blood count, comprehensive metabolic panel, and coagulation studies were within normal limits, and serum acetaminophen and salicylate levels were undetectable.

Poison control was contacted and the toxicologist on call recommended uridine triacetate (Vistogard) be administered.

On follow up call, it was revealed the hospital did not carry uridine triacetate, the oncology service was unsure on how to obtain it, and the nearest tertiary care center also did not carry it.

Ultimately, a vendor in the region was contacted and the antidote was delivered for administration 17 hours after the patient’s ingestion. The patient completed treatment over five days and was discharged home asymptomatic with planned follow-up labs.

**Discussion**

The fluoropyrimidine chemotherapeutics are uridine analogues that competitively disrupt DNA synthesis. 5-Fluorouracil (5-FU) is used to treat breast and colorectal cancers, but requires intravenous administration due to unreliable oral absorption.

Capecitabine is an oral prodrug of 5-flurouracil that is metabolized to 5-FU. Effects from Intentional self-poisoning or accidental overdose with capecitabine can be severe unless ameliorated with uridine triacetate.

Uridine triacetate (Vistogard) is an oral antidote used to treat 5-FU or capecitabine toxicity from overdose or critical enzyme deficiency. RNA synthesis is protected through competitive inhibition of toxic 5-FU metabolites. Compared to historical controls, uridine triacetate improved survival from 5-FU or capecitabine overdose from 9.5% to 96%.

However, the timing of administration is important. In one comparison, all eighteen patients given the antidote within 96 hours survived compared to only 3 out of eight patients administered the antidote after 96 hours.

**Summary**

Oral chemotherapeutics such as capecitabine offer patients an attractive home alternative to traditional infusions. However, its use may contribute to an increase in accidental and intentional fluoropyrimidine poisonings.

Given the effectiveness of uridine triacetate as an antidote, it is imperative that hospitals and physicians understand its importance in managing toxicity and have a plan for rapid obtainment and administration in place.

**Labs**

Sodium of 139 meq/L, Potassium of 4.4 meq/L, Bicarbonate of 20 meq/L, Blood urea nitrogen of 7 mg/dL, Glucose of 137 mg/dL, Alanine aminotransferase of <6 units/L, Aspartate aminotransferase of 24 units/L, Prothrombin time of 12.3 seconds, and an International normalized ratio of 1. Complete blood count showed a white blood cell count of 6.8 x10^9/L, hemoglobin of 15.6 mg/dL, hematocrit of 45.6%, and platelets of 204 x10^9/L.

**Acknowledgements**

Thank you to the poison specialists at the California Poison Control centers in Sacramento and San Diego for helping our clinical partners navigate the procurement of the Vistogard.
BACKGROUND

• Each year, poison centers in the United States receive several thousand calls for venomous snake bites. In the western United States, bites are almost entirely from rattlesnakes.

• Symptoms of rattlesnake envenomation include local tissue damage, hemotoxicity, and less commonly, neurotoxicity.

• Antivenom reduces these effects, but historically was complicated by both acute and delayed hypersensitivity reactions, which is less frequently observed with Crotalidae polyvalent immune Fab (FabAV). In 2015, the Food and Drug Administration approved Crotalidae immune F(ab’)2 for rattlesnake envenomation.

• We report the case of a 13-year-old male who suffered an acute hypersensitivity reaction from F(ab’)2 administered for rattlesnake envenomation.

THE CASE:

A 13-year-old male presented to the emergency department 1 hour after being bitten on his left shin by a rattlesnake while walking his dog.

Initial findings were remarkable for local edema and severe global paresthesias. Complete blood count, coagulation studies, and fibrinogen were within normal limits.

Ten vials of F(ab’)2 antivenom were administered at an initial rate of 25 cc/hr for 10 minutes before increasing to 250 cc/hr. The patient’s paresthesias resolved. During transport to the pediatric intensive care unit (PICU), the patient developed diffuse urticaria, wheezing, and facial edema. The infusion was immediately stopped and diphenhydramine, methylprednisolone, and albuterol nebulizers were administered. Epinephrine was recommended, but not administered. Approximately 180/250 ccs of F(ab’)2 had been administered.

The Respiratory symptoms rapidly improved and the facial edema and urticarial resolved overnight.

Local symptoms remained stable and labs remained within normal limits.

The patient was discharged home on hospital day 3.

Discussion:

• Acute and delayed hypersensitivity reactions are a known danger with animal derived antivenom preparations.

• The polyvalent whole immunoglobulin G antivenin showed rates of acute and delayed reaction of near 20% and 50% respectively.

• The FabAV product reduced immunogenicity by removing the Fc antibody region through papain digestion and purification with an affinity chromatography column. Hypersensitivity reactions are 5-6%.

• The F(ab’)2 product uses pepsin to cleave off the Fc antibody region, leaving a larger particle of two fab fragments. However, an affinity chromatography column is not used in purification. Rates of hypersensitivity reactions are initially comparable to the FabAV product.

Conclusion:

• The newer FabAV and F(ab’)2 products have reduced the occurrence of acute hypersensitivity reactions compared to older whole IgG antivenom. However, patients remain at risk for hypersensitivity reactions when administered animal derived antivenom.

• Our case highlights the need for ongoing surveillance of the new F(ab’)2 product to determine the incidence of acute hypersensitivity reactions when used to treat rattlesnake envenomation in humans.
The Force Awakens: Packets, Baggies, and Delayed Toxicosis. A Case Report

David Perez-Lauterbach, MD | Robert Cole Pueringer, MD | Hsiao-Ting Regelman, PharmD | Ted Gray, RPh
Samantha C. Lee, PharmD | Alexandru Ulici, PharmD | Travis Olives, MD, MPH, MEd
Hennepin Healthcare | Minnesota Poison Control System | Minneapolis, Minnesota

<table>
<thead>
<tr>
<th>Background</th>
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<tbody>
<tr>
<td>Drug stuffers ingest poorly packaged illicit substances without prior planning, and are commonly incentivized to provide false reports enabling escape from police custody. This results in a potential bias toward favorable outcomes. We present two cases of markedly delayed severe toxicity in polysubstance stuffers.</td>
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</tbody>
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<table>
<thead>
<tr>
<th>Case Report 1</th>
</tr>
</thead>
<tbody>
<tr>
<td>A 29yo male ingested drug ‘rocks’ during police detainment and subsequently became unconscious and apneic. He was intubated and given activated charcoal. Confirmatory urine testing was positive for methamphetamine and amphetamine.</td>
</tr>
<tr>
<td>Following ICU admission, he was hypotensive despite 5L of fluid; norepinephrine infusion provided hemodynamic support through HD4. Hospital course was prolonged by aspiration pneumonia and agitation with weaning attempts. On HD5 he had an episode of charcoal emesis, CT was without evidence of bowel obstruction, and on HD7, he became abruptly tachypneic (RR 40s), hypertensive (&gt;200 systolic), tachycardic (&gt;150 beats/min), and febrile (&gt;40°C). He was treated presumptively for sympathomimetic toxicity from packet rupture with midazolam bolus/infusion, lorazepam, and vecuronium with resolution of vital sign abnormalities.</td>
</tr>
<tr>
<td>Repeat confirmatory urine testing revealed methamphetamine without amphetamines, verifying recurrent methamphetamine exposure.</td>
</tr>
<tr>
<td>His hospital course was complicated by MRSA pneumonia and ARDS. He was extubated on HD19 and discharged to acute rehabilitation on HD26.</td>
</tr>
</tbody>
</table>

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<thead>
<tr>
<th>Case Report 2</th>
</tr>
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<tbody>
<tr>
<td>A 20yo male reported a suicidal ingestion of “$500 worth” of heroin, cocaine, fentanyl, marijuana, and methamphetamine. He was alert and oriented on EMS assessment, but became somnolent shortly after arrival. Presenting laboratory values revealed no alternate etiology of his altered sensorium.</td>
</tr>
<tr>
<td>Radiodense objects consistent with drug packets were noted in the gastric antrum on presenting radiographs. He was intubated for airway protection after one hour, and admitted to the medical ICU.</td>
</tr>
<tr>
<td>Activated charcoal followed by whole bowel irrigation. Several small baggies were retrieved per rectum on hospital day (HD) 2.</td>
</tr>
<tr>
<td>Early on the morning of HD3 the patient developed acute, unprovoked agitation, vomiting around his endotracheal tube, tachycardia to 130 beats/min, and hypertension (160s/80s) despite propofol at 80mcg/kg/min. Symptoms were unremitting with increased propofol (140mcg/kg/min), intravenously boluses of fentanyl (100mcg) and ketamine (50mg). He received &gt;50mg of lorazepam intravenously over several minutes, eventual paralysis with vecuronium and sedation with midazolam (20mg/hr). ARDS ensued; repeat abdominal radiograph revealed two persistent packets within the ascending colon.</td>
</tr>
<tr>
<td>Urine testing on HD3 revealed methamphetamine and amphetamine, suggestive of recurrent or ongoing methamphetamine exposure. Following a complicated course, the patient discharged to an outpatient treatment center on HD15.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Case Discussion</th>
</tr>
</thead>
<tbody>
<tr>
<td>We present two cases of life-threatening sympathomimetic toxicity secondary to delayed rupture of stuffed packets. In both cases, the acute development of sympathomimetic toxicity strongly suggested recurrent exposure.</td>
</tr>
<tr>
<td>Symptom timing and confirmatory urine testing supported delayed packet rupture.</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Conclusions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Evidence guiding the management of drug stuffers remains limited.</td>
</tr>
<tr>
<td>These cases suggest ongoing risk of delayed rupture and life-threatening toxicity, highlighting the importance of vigilance for a “second packet” phenomenon, even when initial presentation suggests content spillage.</td>
</tr>
</tbody>
</table>
A 24-hour observation time is hard to swallow: Evidence for 8 hours of observation of methamphetamine stuffer

Ann M Arons, MD 1,2 | Samantha C Lee, PharmD 1 | Robert C Pueringer, MD 1 | Christopher Sweat, MD 1 | Justin Corcoran, MD 1 | Sarah Knack, MD 1 | Jon B Cole, MD 1,2 | Travis D Olives, MD, MPH 1,2
1 Minnesota Poison Control System, Minneapolis, MN; 2 Department of Emergency Medicine, Hennepin Healthcare, Minneapolis, MN

Background

- Body stuffing is the intentional ingestion, or insertion into another orifice, of an illicit drug in a quickly packaged or unpackage form with intent to dispose of evidence or to evade arrest.
- A previous case series demonstrated a high proportion of severe adverse outcomes in methamphetamine body stuffers, and thus Minnesota Poison Control System (MPCS) currently recommends 24h observation for these cases.
- The optimal length of observation is, however, unknown.

Objectives

To describe: the demographics, clinical characteristics, therapeutic interventions, discharge, and clinical outcomes of methamphetamine stuffers treated at a single institution.

Methods

- To identify patients, ToxicCall® database, the EMR utilized by MPCS (located within Hennepin County Medical Center, HCMC), was reviewed for all patients with “methamphetamine” listed as a substance, with “intentional misuse or abuse/unknown” listed as a reason for use from 1/1/2007-12/31/2019.
- Patients of all ages were included if they were identified as having “stuffed” methamphetamine and were treated at HCMC.
  - Includes patients who stuffed multiple medications/drugs, if the drugs were unWrapped, or if the method of wrapping was unknown.
  - Excluded: drug was unknown, duplicate cases, or if outcomes could not be determined.
- The patient’s institutional (HCMC) Epic® chart was then reviewed by the authors to gather demographic and clinical information. This study was approved by the institution’s IRB.

Table 1. Patient demographics and ingestion information.

<table>
<thead>
<tr>
<th>Patient Demographic/Ingestion Information</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Age in years (median, range)</td>
<td>29 (17-64)</td>
</tr>
<tr>
<td>Gender, male n (%)</td>
<td>128 (64.0)</td>
</tr>
<tr>
<td>Time to arrival after stuffing (median, range)</td>
<td>6min (6min-6d)</td>
</tr>
<tr>
<td>Methamphetamine stuffing only n (%)</td>
<td>129 (64.3%)</td>
</tr>
</tbody>
</table>

| Recorded amount of methamphetamine stuffed (median, range) | 2g (0.6-15g) |
| Plastic n (%) | 170 (99.5%) |
| Location of stuffing | 149 (74.5%) |
| Oral n (%) | 197 (98.3%) |

Table 2. Emergency Department (ED) presenting signs/symptoms, and disposition.

<table>
<thead>
<tr>
<th>Presenting Signs/Symptoms</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Initial HR (mean, range)</td>
<td>102 (75-180)</td>
</tr>
<tr>
<td>Initial SBP (mean, range)</td>
<td>136 (97-196)</td>
</tr>
<tr>
<td>Initial T°C (mean, range)</td>
<td>36.9 (35.2-41.4)</td>
</tr>
<tr>
<td>T &gt; 38.0°C</td>
<td>6 (3.0)</td>
</tr>
<tr>
<td>Agitation n (%)</td>
<td>55 (27.5)</td>
</tr>
<tr>
<td>AMD = n (%)</td>
<td>56 (28.0)</td>
</tr>
<tr>
<td>Severe n (%)</td>
<td>4 (2.0)</td>
</tr>
<tr>
<td>CNS depression n (%)</td>
<td>30 (15.0)</td>
</tr>
<tr>
<td>Respiratory depression n (%)</td>
<td>1 (0.5)</td>
</tr>
<tr>
<td>ED disposition n (%)</td>
<td>51 (25.5)</td>
</tr>
<tr>
<td>Discharged</td>
<td>149 (74.5)</td>
</tr>
<tr>
<td>Admission Intermediate Care Unit</td>
<td>115 (57.5)</td>
</tr>
<tr>
<td>Intermediate Care Unit</td>
<td>4 (2.0)</td>
</tr>
<tr>
<td>Telemetry or non-telemetry Intermediate Care Unit</td>
<td>30 (15.0)</td>
</tr>
</tbody>
</table>

ED Therapies

<table>
<thead>
<tr>
<th>Indication (n)</th>
<th>Time from admission (mean, range)</th>
<th>Time from ingestion (mean, range)</th>
<th>Medication given for sedation n (%)</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>22 (12.0)</td>
<td>69min (3-480)</td>
<td>150min (25-450)</td>
<td>94 (47.2)</td>
<td></td>
</tr>
<tr>
<td>1 (0.5)</td>
<td>371min</td>
<td></td>
<td>21 (10.5)</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Inpatient Therapies</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Indication (n)</td>
<td></td>
</tr>
<tr>
<td>Time from admission</td>
<td></td>
</tr>
<tr>
<td>Medication given for sedation</td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Final Disposition/Outcome</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Home</td>
<td>68 (34.0)</td>
</tr>
<tr>
<td>Jail</td>
<td>86 (43.0)</td>
</tr>
<tr>
<td>Psychiatric or Substance Use Disorder Treatment</td>
<td>6 (3.0)</td>
</tr>
</tbody>
</table>

Results

- 2,300 Toxicall® charts were reviewed, and 200 patients were included in the final analysis.
- One (0.5%) patient was intubated as an inpatient approximately 9 hours after arrival in the ED for somnolence following sedation for agitation.
- One (0.5%) patient who developed tachycardia at greater than 8 hours had a HR 107bpm without additional symptoms.
- Eight (4.0%) patients developed tachycardia during inpatient observation, not attributed to methamphetamine toxicity.
- Two (1.0%) patients developed hyperthermia in the ED, both within 2 hours of arrival.
  - Four (2.0%) patients developed hyperthermia as inpatients: 2 attributed to infection, and 2 were already intubated for methamphetamine toxicity.
- Three (1.5%) patients developed agitation or altered mental status (AMS) within 70min of ED arrival, and one patient developed AMS 6 hours after arrival to the ED.

Conclusions

This review supports an 8 hour observation time for asymptomatic methamphetamine stuffers with normal vital signs.

- These results require external validation.
An increased rate of opioid overdoses presenting to emergency departments during COVID-19

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Virginia Commonwealth University, Richmond, VA

INTRODUCTION

• The SARS-CoV-2 (COVID-19) pandemic began during an opioid overdose (OD) crisis in the United States, which has been primarily fueled by fentanyl and fentanyl analogs in recent years.\(^1\)\(^2\)

• Psychosocial consequences of COVID-19 may heighten the risk of relapse and experiencing an opioid OD.\(^3\)\(^4\)\(^5\)

• A recent study showed increased EMS response to opioid ODs in the 52 days after the COVID-19 State of Emergency Declaration in Kentucky compared to the preceding 52 days.\(^6\)

• Study aim: To compare the rates of unintentional opioid OD emergency department (ED) visits in Virginia during the COVID-19 pandemic with the previous year.

METHODS

• Data on the rate of opioid OD visits to EDs were obtained from the Virginia Department of Health\(^6\).

• Unintentional opioid OD visits were identified from chief complaint terms and ICD-9 and ICD-10 diagnostic codes.

• The rate of unintentional opioid ODs was represented as the mean rate per 10,000 ED visits.

• The rate was adjusted by using the total number of ED visits in a specific Virginia region or city as denominator.

• We compared rates of opioid OD ED visits from March-June 2019 vs. March-June 2020.

RESULTS

Opioid overdoses per 10,000 ED visits: Virginia Department of Health regions

Opioid overdoses per 10,000 ED visits: Richmond City

DISCUSSION

• The rate of unintentional opioid OD ED visits increased during the COVID-19 pandemic compared to the previous year.

• The etiology underlying this increased rate is insufficiently characterized, but undoubtedly multi-factorial.\(^3\)

• Given the marked increased risk of subsequent death after a non-fatal OD,\(^7\) it is critical for clinicians to consider innovative ways to improve prevention and treatment efforts\(^8\) during the ED visit.

REFERENCES


ACKNOWLEDGEMENTS

This work was supported in part by a research training grant (NIDA T32 DA7027-44), as well as NIH research grants (UL1TR002649, U54DA038999).

Email: taylor.ochalek@vcuhealth.org
Effect of Pharmacist Education and Intervention on Ketorolac Prescribing in an Emergency Department

Michael E. O’Brien, PharmD; Lanting Fuh, PharmD; Benjamin A. White, MD; Jason K. Bowman, MD; Bryan D. Hayes, PharmD

Massachusetts General Hospital, Boston, MA

Background

- Pharmacists serve many important roles within the emergency department (ED) and their presence is recommended by numerous organizations to improve patient care and ensure safety. One of these roles is to continuously educate healthcare providers on medication use and safe prescribing as new practices emerge in the literature.
- A 2016 randomized double-blind trial found that 3 doses of intravenous (IV) ketorolac (10, 15, and 30 mg) provided similar analgesia. This study demonstrated a potential “analgesic ceiling” effect and suggested that doses lower than 30 mg IV may be equally efficacious for most patients.
- After this study was published, we implemented reduced-dose ketorolac as standard practice in our institution’s ED.

Purpose

- To assess the impact pharmacist education and on-shift interventions had on ED clinician prescribing habits of IV ketorolac

Endpoints

- Change in number of ketorolac medication orders for 15 mg and 30 mg doses pre-/post-implementation

Methods

- An email was sent to all emergency medicine clinicians and active interventions via real-time feedback to clinicians on-shift, were chosen as the methods to achieve this practice change.
- Pharmacists performed on-shift interventions for any IV ketorolac orders above 15 mg. An active intervention occurred when a pharmacist contacted a prescriber to ask that a ketorolac dose be changed based on the Motov study.
- The pre-implementation period was 180 days prior to the email intervention (6/23/2016-12/19/2016) and the post-implementation period was 180 days following the email intervention (12/21/2016-6/18/2017). The date the email was sent (12/20/2016) was excluded to provide a brief washout period.
- The EMR was updated to prompt providers to choose ketorolac 15 mg IV in January 2018, thus the study period did not overlap.
- In order to compare the effect of the email alone to email plus active intervention by pharmacists, we compared orders placed during the day and evening shifts, when pharmacists were actively present in the ED (7:00-22:30), with overnight shifts, when pharmacists were not physically present.

Results

- Figure 1: Total ketorolac orders pre-/post-implementation
- Figure 2: Ketorolac orders throughout study period by dose
- Figure 3: Ketorolac orders placed between 7:00 am and 10:30 pm
- Figure 4: Ketorolac orders placed between 10:30 pm and 7:00 am

Limitations

- Limitations of this study include inability to adjust for confounding variables given retrospective design and potentially limited practice variation given this was a single center study.

Discussion

- In this retrospective study, we analyzed the prescribing pattern of IV ketorolac in our ED before and after clinician education regarding a practice update.
- We found that 30 mg of IV ketorolac was the predominant dose prescribed prior to our intervention and this significantly changed such that 15 mg was significantly more common following our education.
- This significant change appeared to persist long after the educational email and through the end of our study period (Figures 1-4).

References


Disclosures

The authors of this presentation have no financial or personal relationships with commercial entities that may have a direct or indirect interest in the subject matter of this presentation to disclose.
Background

• Many U.S Poison Centers (PCs) are based at hospitals; communication regarding poisoned patients inside the hospital can be inefficient, leading to delays in care or errors.
• To minimize these inefficiencies, we sought to use our hospital’s existing “Pharmacist Scope of Practice” policy to streamline care.
• Goal: Have poison center SPIs who are also pharmacists order labs and levels related to drug therapy monitoring for selected poisoned patients.

Methods

• This quality improvement project was deemed exempt by our IRB and approved by our hospital’s Pharmacy & Therapeutics committee.
• Our poison center is based within a level-1 trauma center safety-net hospital with a toxicology laboratory capable of performing all labs noted in Table 1 in the usual course of clinical care, 24 hours a day, 365 days per year.
• Under our hospital’s “Pharmacist Scope of Practice” policy, a pharmacist may place orders including, but not limited to, laboratory tests for serum drug levels, renal function, or any other laboratory test required for appropriate medication monitoring.
• The initial scope included a limited number of substances (see Table 1).
• The pharmacist-SPI could review the electronic medical record (EMR; Epic®, Verona, WI), and if labs or levels needed to be ordered or time changed, the pharmacist contacted the team to discuss and offer to place orders/make any changes.
• A note would then be placed in the EMR (template displayed in Table 2), to communicate which labs/levels were ordered and for what time.
• Cases that used this new policy were collected using the Poison Center’s EMR (Toxicall®, Computer Animation Systems, Inc, Aurora, CO) for patients with exposures listed in Table 1.

Results

• From June 10, 2019 through December 31, 2019, 33 patients met criteria to have orders placed by a pharmacist-SPI.
• Of the 33 eligible patients (24 acetaminophen, 3 salicylates, 3 lithium, 2 toxic alcohols, and 1 iron), orders were placed for 5 patients (15.2%)
  • 3 acetaminophen exposures: APAP, LFT, INR
  • 1 aspirin exposure: ASA levels
  • 1 lithium exposure: lithium levels, BMP
• The pharmacist-SPIs extended offers to place orders on 6 patients; indicating a success rate of 5/6 (83%) when an offer was made.
• Three pharmacist-SPIs placed the orders on these 5 patients.

Conclusion

• Though the opportunities were rare and adoption to a new process can take time, when pharmacist-SPIs offered to place orders for hospitalized poisoned patients, treatment teams commonly accepted.
• Moving forward, as pharmacist-SPIs get more comfortable with the process, we hope to place orders for the majority of poisoned patients at our host institution.
• Overall, it is feasible for pharmacist-SPIs to place orders for antidote monitoring in hospitalized poisoned patients at our hospital.
Background

- U.S. suicide rates have increased yearly since 2000
- Youth suicide rates are increasing the fastest at any age group
- In 2018, Utah was 5th in the nation for age-adjusted suicide rate and 7th for suicide as a leading cause of death

Methods

- Retrospective descriptive review of UPCC data
- Study period: January 1, 2009 to December 31, 2019
- Case inclusion criteria: NPDS coding reason “int-susp suicide”, human, aged 6 years to 19 years
- Excluded nonresident patients
- Analyzed data regarding age, gender, substance exposure, and all outcomes for each year
- Trends characterized using descriptive statistics

Results

- 12,015 total cases of adolescent suicide attempts during the study period (Figure 1, Table 1)
- 96% of all suicide attempts reported involved ages 13-19 years
- The largest group was age 16 years (18.9%)
- Rate of reported suicide attempts in ages 11-19 years all showed increase over the study period (Figure 2)
- Rate of age group 15-17 increased the most
- Rate of suicide reported in ages 6-9 years remained relatively consistent
- Substance exposures organized into 3 categories

Results Continued

- Of the total substance count of 19,124
  - 50.29% (9,618) substance exposures were prescription medications
  - 46.07% (8,610) were OTC products
  - 3.64% (696) were illicit substances

- Of the total 12,015 cases reviewed (Figure 3)
  - All outcomes (minor, moderate, major, no effect) cumulative percent rate change increased over time
  - The cumulative percent rate change of major outcomes rose higher as compared to the cumulative percent rate change of moderate, minor, and no effect outcomes over the study period
    - Major outcomes cumulative percent rate change 38%
    - Moderate outcomes cumulative percent rate change 24%
    - Minor outcomes cumulative percent rate change 12%
    - No effect outcomes cumulative percent rate change 20%

Table 1: Utah Adolescent Suicide Patient Characteristics (Total Cases N=12,015)

<table>
<thead>
<tr>
<th>Gender</th>
<th>Female</th>
<th>Male</th>
<th>Unknown</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>73.67%</td>
<td>26.33%</td>
<td>0.00%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age Group (yrs)</th>
<th>6-9</th>
<th>10-14</th>
<th>15-17</th>
<th>16-17</th>
</tr>
</thead>
<tbody>
<tr>
<td>%</td>
<td>0.23%</td>
<td>53.20%</td>
<td>46.00%</td>
<td>1.51%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age (yrs)</th>
<th>Mean</th>
<th>Median</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>15.9</td>
<td>16</td>
</tr>
</tbody>
</table>

Figure 1: Utah adolescent suicide rate change by gender between the years 2009-2019

Figure 2: Utah teen suicide rate change between years 2009-2019 per 10,000 exposure calls, separated by age group

Figure 3: Utah cumulative percent rate change separated by all outcome types, between 2009-2019

Conclusion

- This study of trends reported to the UPCC finds increasing yearly rates of suicide attempts among prepubescent female adolescents (73.88%) aged 11-19 years
- The cumulative percent rate change of major outcomes escalated further as compared to all outcomes (minor, moderate, and no effect) over the 11-year period
- These results may represent an increasing population of adolescent suicide attempts with an increasing potential to develop major outcomes
Persistent Hyperinsulinemia Following HIE: Does ECMO Alter Insulin Pharmacokinetics?

Natalie R. Neumann, MD; Ryan M. Fredericks; Pamela D. Reiter; Sarah Pihi; Erin K. Stenson; Christopher M. Ruzas; George S. Wang.

1 Rocky Mountain Poison and Drug Safety, Denver Health and Hospital Authority, Denver, CO; 2 Department of Emergency Medicine, Yale University School of Medicine, New Haven, CT; 3 Department of Pediatrics, Division of Pediatric Critical Care Medicine, Children's Hospital, Colorado, Aurora, CO; 4 Department of Pharmacy, Children’s Hospital Colorado, Aurora, CO; 5 Department of Pediatrics, Section of Emergency Medicine, Children’s Hospital Colorado, Aurora, CO

Table 1: Patient Course

<table>
<thead>
<tr>
<th>Admission Day</th>
<th>1</th>
<th>2</th>
<th>3</th>
<th>4</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Time</td>
<td>16:00</td>
<td>21:35</td>
<td>23:04</td>
<td>01:00</td>
</tr>
<tr>
<td>Event Time</td>
<td>Reported Time</td>
<td>Patient Arrives to ED</td>
<td>HE: Start</td>
<td>HE: End</td>
</tr>
<tr>
<td>HIE Start</td>
<td>00:00</td>
<td>03:00</td>
<td>09:00</td>
<td>16:00</td>
</tr>
<tr>
<td>HIE Increase</td>
<td>17:34</td>
<td>17:40</td>
<td>18:20</td>
<td>23:40</td>
</tr>
<tr>
<td>HIE Decrease</td>
<td>13:34</td>
<td>13:40</td>
<td>18:30</td>
<td>22:30</td>
</tr>
<tr>
<td>HIE Stop</td>
<td>21:36</td>
<td>22:31</td>
<td>22:40</td>
<td>00:00</td>
</tr>
<tr>
<td>Time</td>
<td>00:19</td>
<td>03:02</td>
<td>03:06</td>
<td>03:55</td>
</tr>
<tr>
<td>Time</td>
<td>07:12</td>
<td>08:07</td>
<td>10:13</td>
<td>13:13</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Event</th>
<th>08:47</th>
</tr>
</thead>
<tbody>
<tr>
<td>Event</td>
<td>10:13</td>
</tr>
<tr>
<td>Time</td>
<td>13:13</td>
</tr>
<tr>
<td>Time</td>
<td>16:13</td>
</tr>
</tbody>
</table>
| CASE REPORT
| A 15-year-old, 52.5kg female presented to the emergency department approximately five hours after an intentional polypharmacy ingestion.
| Initial labs revealed undetectable aspxirin, ethanol, and acetaminophen concentrations. A urine drug screen was negative. An amiodopine concentration drawn approximately 9 hours after the reported ingestion was 62 ng/mL (reference range 2-25 ng/mL).
| The patient’s arrival vital signs at 21:35 included: blood pressure 69/35 mmHg and pulse 100 beats-per-minute. Her initial blood glucose was 160 mg/dL.
| The patient was noted to develop recurrent hypoglycemia after ECMO. Her hospital course is presented in table 1.

| BACKGROUND
| Extracorporeal membrane oxygenation (ECMO) is a critical intervention for managing poisoned patients with persistent hemodynamic instability.
| Limited data are available describing how ECMO affects drug pharmacokinetics.
| We present a case of recurrent hypoglycemia and hyperinsulinemia hours after hyperinsulinemia-eglycemic therapy (HIE) was terminated in the setting of ECMO for calcium channel blocker (CCB) toxicity.

| CONCLUSION
| Normal elimination half-life of regular intravenous insulin is 5-15 minutes.
| This patient had persistently elevated insulin concentrations and recurrent hypoglycemia for 16 hours after discontinuation of HIE.
| The persistently elevated insulin concentration and prolonged half-life, despite improvement in renal function, suggests that the ECMO circuit impacted the distribution, metabolism, or elimination of exogenous insulin.
| Clinicians should be aware that ECMO use may significantly alter drug disposition.
| Insulin and its effects may persist hours after its use for HIE in the setting of CCB toxicity.
Physostigmine Use to Treat Anticholinergic Toxidrome in Pediatric Patients as Reported to the National Poison Data System

Sarah Huber, BS1 • Bob Avera, MD2,3 • Adam Overberg, PharmD, BCPS, CSP123 • Shannon Morton, MPH1 • Kristine Nanagas, MD2,3
Indiana University School of Medicine and Indiana Clinical and Translational Sciences Institute1 • Indiana University School of Medicine: Dept of Emergency Medicine2 • Indiana Poison Center, Indianapolis, IN3

BACKGROUND
- Physostigmine is the antidote to anticholinergic poisoning
- There is a lack of data on the efficacy or safety of physostigmine in pediatric populations, despite recent evidence in adult populations
- We sought to establish the prevalence of pediatric anticholinergic toxicity and physostigmine administration
- We also sought to determine the prevalence of exposure types and determine the difference in outcomes

METHODS
- All human exposure cases reported to National Poison Data System (NPDS) from January 1, 2013 – December 31, 2017 for ages 2-18 years that were exposed to one of the selected xenobiotics
- Four cohorts were established: no therapy, benzodiazepines therapy alone, physostigmine therapy alone, and combination therapy with benzos and physostigmine
- Analyzed outcomes using medical outcome classifications of No effect, Minor, Moderate, Major, or Death

RESULTS
- Physostigmine is the antidote to anticholinergic poisoning
- There is a lack of data on the efficacy or safety of physostigmine in pediatric populations, despite recent evidence in adult populations
- We sought to establish the prevalence of pediatric anticholinergic toxicity and physostigmine administration
- We also sought to determine the prevalence of exposure types and determine the difference in outcomes

CONCLUSIONS
- The numbers of pediatric patients with anticholinergic toxicity have increased over time
- Rates of physostigmine treatment have remained constant, while treatment with benzodiazepines has increased
- There has been no increase in illness severity in those treated with physostigmine
- Literature supports the safety profile and efficacy of physostigmine in the treatment of anticholinergic toxicity, but pediatric patients are still more likely to be treated with benzodiazepines alone than with physostigmine

REFERENCES

Table 1: Medical Outcomes by Treatment Group
We included 81,969 cases from the NPDS. Of the 3,830 cases that received specific treatment, 86.8% received only benzos, 11.4% received both benzos and physostigmine, and 1.9% received physostigmine alone. No mortalities were reported in any cases that received physostigmine.
Lithium poisoning is common with 7055 exposures reported in 2018 NPDS. Lithium toxicity may require hemodialysis which is not immediately available in all settings. Sodium zirconium cyclosilicate (SZC, Lokelma®) is an oral potassium binding agent indicated for hyperkalemia. It is unknown whether SZC binds Lithium.

**OBJECTIVE**

To determine whether SZC will bind Li+ ions in-vitro at concentrations of clinical interest (≥ 2.5 mmol/L).

**METHODS**

- Normal saline (NS) is added to 6mL lithium-heparin tubes with target [Li+] ≥ 2.5 mmol/L.
- Volume of NS added: 0.5, 1, 2, 3, 4, and 5 ml

**RESULTS**

Increasing concentrations of SZC had no effect on Li+ concentrations. (Table 1 and Figure 1).

<table>
<thead>
<tr>
<th>Volume</th>
<th>0.5 mL</th>
<th>0.75 mL</th>
<th>1.0 mL</th>
</tr>
</thead>
<tbody>
<tr>
<td>Run 1</td>
<td>Na+</td>
<td>Li+</td>
<td>Na+</td>
</tr>
<tr>
<td>1</td>
<td>120.0</td>
<td>5.99</td>
<td>119.0</td>
</tr>
<tr>
<td>2</td>
<td>107.0</td>
<td>5.12</td>
<td>106.0</td>
</tr>
<tr>
<td>Run 2</td>
<td>Na+</td>
<td>Li+</td>
<td>Na+</td>
</tr>
<tr>
<td>1</td>
<td>108.0</td>
<td>5.24</td>
<td>107.0</td>
</tr>
<tr>
<td>2</td>
<td>106.0</td>
<td>5.47</td>
<td>105.0</td>
</tr>
</tbody>
</table>

- Stock solutions of 0.1, 0.2, 0.5, 1, and 5 mg/mL of SZC in deionized water were added in 0.5, 0.75, and 1 mL aliquots to NS/Lithium-heparin tubes in two runs.
- Li+ and Na+ were measured with Roche 9180 Electrolyte Analyzer with an ion selective electrode.

**CONCLUSION**

Sodium zirconium cyclosilicate does not reduce the lithium concentration in this in-vitro model.
INTRODUCTION

- Sodium nitrite has been used as a food preservative, to prevent microbial growth and add a pink color to meat, fish and cheese.
- It is also used as an anti-corrosive, in woodworking and in rubber manufacturing.
- It was previously a mainstay of therapy for cyanide toxicity, when combined with sodium thiosulfate.
- It is an odorless white crystalline powder easily confused with table salt.
- Published exposures mainly describe inadvertent ingestions, but rarely, sodium nitrite has been used in intentional overdoses for the purpose of suicide.

CASE SERIES

- Between May and November of 2019, the California Poison Control System (CPCS) consulted on five patients after intentional ingestions of sodium nitrite.
- No cases of intentional sodium nitrite ingestion had been reported to the CPCS over the preceding five year period.

<table>
<thead>
<tr>
<th>Age</th>
<th>Sex</th>
<th>Estimated Amount Ingested (grams)</th>
<th>Initial Blood Pressure (mmHg)</th>
<th>Initial Heart Rate (beats per minute)</th>
<th>Initial Oxygen Saturation</th>
<th>Peak Methemoglobin Level</th>
<th>Treatment</th>
<th>Outcome</th>
</tr>
</thead>
<tbody>
<tr>
<td>18</td>
<td>M</td>
<td>15</td>
<td>109/58</td>
<td>95</td>
<td>90%</td>
<td>71%</td>
<td>Methylene blue (1.5mg/kg)</td>
<td>Survived</td>
</tr>
<tr>
<td>16</td>
<td>F</td>
<td>60</td>
<td>101/59</td>
<td>128</td>
<td>76%</td>
<td>73%</td>
<td>Methylene blue (8mg/kg), 2U pRBCs</td>
<td>Survived</td>
</tr>
<tr>
<td>27</td>
<td>M</td>
<td>15</td>
<td>116/68</td>
<td>72</td>
<td>68%</td>
<td>&gt;32.4%</td>
<td>Methylene blue (2mg/kg)</td>
<td>Died</td>
</tr>
<tr>
<td>16</td>
<td>F</td>
<td>unknown</td>
<td>N/A</td>
<td>N/A</td>
<td>N/A</td>
<td>=30</td>
<td>Methylene blue (2mg/kg), 1U pRBCs</td>
<td>Died</td>
</tr>
<tr>
<td>25</td>
<td>M</td>
<td>113</td>
<td>98/64</td>
<td>95</td>
<td>80%</td>
<td>undetectably high</td>
<td>Methylene blue (1mg/kg)</td>
<td>Died</td>
</tr>
</tbody>
</table>

DISCUSSION

- Nitrites induce toxicity through the oxidation of ferrous iron (Fe2+) to ferric iron (Fe3+) in hemoglobin, producing methemoglobin, which is unable to bind oxygen resulting in a functional anemia, diminished oxygen delivery to the tissues, and the development of lactic acidosis.
- Nitrites also act as potent vasodilators in the peripheral vasculature which can produce vasodilatory shock.
- The lethal dose of sodium nitrite is reported to be approximately 1 gram.
- Treatment focuses on supportive care and the administration of the IV antidote methylene blue.
- Alternative treatments include RBC or exchange transfusions to replace dysfunctional hemoglobin.

CONCLUSION

- Massive ingestions of sodium nitrite will likely require early and aggressive interventions, including higher starting doses of methylene blue, with possible need for repeated dosing, and consideration of RBC or exchange transfusion.
- Persons working in food processing or other manufacturing plants that utilize sodium nitrite could be at a higher risk due to easier accessibility to the concentrated product.
Pediatric Ingestion of Expanding Polymer Beads requiring Surgical Intervention

Taylor J Rhien PharmD, Michael J Moss MD
Utah Poison Control Center, College of Pharmacy, University of Utah, Salt Lake City, Utah

Background
- Expanding polymer beads, or water beads, are a children’s toy composed of a superabsorbent polymer, which swells to many times its initial size when soaked in water.
- We were able to identify two published cases of intestinal obstruction requiring endoscopy or surgical intervention.
- We present another case of expanding polymer bead ingestion requiring surgical intervention.

Case
- A 17 month old male was found with evidence of vomiting during the previous night. Orbeez® brand expanding polymer beads were seen in the vomitus.
- After several more episodes of dark-colored emesis, he was taken to the emergency department and found to be pale, dehydrated, and unable to tolerate oral intake.
- Abdominal x-ray showed no clear evidence of obstruction.
- He was treated with ondansetron, IV fluids, and a suppository without improvement.
- The child was then transferred to the nearest children’s hospital for further observation.

Case Continued
- Multiple bowel movements occurred containing visible beads, but vomiting continued with any attempts of oral intake.
- On hospital day three, abdominal distension was noted and the child was taken to the operating room for esophagogastroduodenoscopy. A bead was seen obstructing the duodenal bulb, but was unable to be removed.
- A laparotomy was performed which revealed an additional swollen bead in the mid jejunum and another in the proximal ileum.
- All three obstructing beads were removed through a single jejunotomy site.
- The child subsequently improved and was discharged on hospital day five.

Discussion
- Expanding polymer beads are often marketed as safe and non-toxic. Because ingestions are common and rarely result in serious effects, it is easy to disregard potential dangers. Referral to an emergency department or hospital admission may be avoided due to perceived safety.
- A similar product was removed from the market in 2012 after causing intestinal obstruction.
- Prior in vitro data suggested Orbeez would be unlikely to swell sufficiently to cause obstruction.
- A retrospective poison center study of 110 cases found none requiring surgery or endoscopy.
- Two cases reports have since been published with intestinal obstruction. One required endoscopic removal and the other required surgical removal.
- This case demonstrates the possibility of major effects and occasional need for imaging, endoscopy, or surgical intervention.

Conclusion
- Pediatric ingestions of expanding polymer beads can frequently be managed at home.
- Children with persistent vomiting, abdominal pain, or poor oral intake should be evaluated for potential intestinal obstruction.
Two Cases of Unintentional Alpha-Lipoic Acid (ALA) Poisoning in Adults

Morley R, Ngo K, Arnold J 1,2
1 Florida Poison Information Center Tampa
2 University of South Florida

CARE REPORT #1
- 31 y.o. female presented to ED with complaints of headache, abdominal pain and cramping, diarrhea, and suspected DIC with possible infection. She had been receiving infusions of ALA with glutathione, B vitamins, vitamin C, and magnesium for weight loss.
- Labs: WBC 22,900, Hgb 10.8, Hct 32.6%, plt 44,000, INR 1.4, fibrinogen 168, AST 119, ALT 71, HCO3 26 mEq/L, anion gap 8
- Day 2: Plt 10,000 and d-dimer 930 ng/mL.
**Treatment and Course:**
- Platelet infusion and antibiotics
- Pt recovered and was discharged on day 4 of hospital stay.

CARE REPORT #2
- 78 y.o. female presented to ED after ingesting five of her husband’s ALA 600 mg by accident. Initial complaints of nausea, vomiting, weakness were rapidly followed by flushing, confusion, and hypertension (160/127)
- Labs: Hgb 10.2 g/dL, lactate 3.4 mMol/L, AST 18, ALT 14, HCO3 17 mEq/L, anion gap 18
**Treatment and Course:**
- Ondansetron, promethazine, and IV fluids
- Pt improved the next day and was discharged.

BACKGROUND
- Alpha-Lipoic Acid (ALA) is a nutraceutical product in the United States.
- ALA and its reduced form, dihydrolipoic acid (DHLA), are antioxidants and function as ROS scavengers and as a cofactor in several enzyme systems, including the citric acid cycle.
- ALA poisoning is rarely reported in the literature. There are case reports (about 7 in accordance with our literature search) and these patients develop delirium, agitation, lethargy, seizures, thrombocytopenia, coagulopathy, lactic acidosis, rhabdomyolysis, multiorgan failure, ventricular fibrillation and death.
- Previously reported cases have highlighted unintentional oral exposures predominantly in children and suicide attempts.

DISCUSSION
- In both patients, GI symptoms preceded neurologic and hematologic effects.
- Both cases highlight the narrow therapeutic window of ALA.
- Our cases add to the literature in describing a novel route of administration (intravenous) as well as an unintentional experience in the elderly population.
**DISCUSSION**

Isolated perampanel overdose with lethargy for 48 hours

Kayleigh Mitchell, PharmD, Bryan Wilson, MD, Jaiva Larsen, MD
Arizona Poison and Drug Information Center, University of Arizona, Tucson, AZ

- We can reasonably anticipate that perampanel overdose, as a result of suicide attempt or recreational misadventure, will increase in incidence as the drug is more widely prescribed.
- A limited number of cases have been previously described in the literature.
- In our case, no lab abnormalities or changes in vitals noted.
- Symptoms resolved in 48 hours compared to cases which persisted for up to 2 weeks.
- The prolonged central nervous system effects of perampanel is attributed to its long half-life of 105 hours.

**REFERENCES**


**HIGHLIGHTS**

- Perampanel is a newer antiepileptic with limited cases of overdose documented in the literature.
- In this case, intentional overdose of 120 mg (10x home dose) of perampanel resulted in severe lethargy requiring ICU admission which gradually resolved over 48 hours.

**BACKGROUND**

- FYCOMPA® (perampanel) is a newer antiepileptic with a unique mechanism of action and a sparsity of literature on overdose.
- Non-competitive α-amino-3-hydroxy-5-methyl-4-isoxazole-propionate (AMPA) glutamate receptor antagonist generally prescribed as an adjunctive agent for partial and generalized tonic-clonic seizures.
- Initially approved by the US Food and Drug Administration in 2012 as a schedule III controlled substance by the US Drug Enforcement Agency.
- Recommended maintenance dose range for partial-onset seizures: 8-12 mg daily.
- Half-life elimination: 105 hours.
- Common adverse events noted at therapeutic doses include dizziness, somnolence, headache, fatigue, irritability, and ataxia.
- Psychiatric adverse events have been noted including irritability, insomnia, anxiety, depression, and aggression.

**PREVIOUS STUDIES**

- 2 cases are notable for coma and stupor followed by prolonged cognitive and cerebellar impairment lasting up to 2 weeks in adults ingesting over 200 mg of perampanel:
  - One patient developed bradycardia, hyponatremia, and EEG abnormalities.
  - Second patient required intubation and mechanical ventilation.
- 3 cases are notable for stupor lasting several days after smaller 40 to 60 mg, though these cases are complicated by polypharmacy.
  - One case resulted in supratherapeutic levels of valproic acid and hyperammonemia.
- 2 cases describe exploratory ingestions in pediatric patients with lethargy and ataxia lasting 6 to 20 hours.

**STRUCTURE**

- Glutamate Receptor Antagonist

**CASE DETAILS**

- Twenty-two year old female patient:
  - Past medical history:
    - Cerebral palsy
    - Epilepsy
    - Gastric tube due to gastroparesis
  - Home medications: Brivaracetam, clobazam, lamotrigine and perampanel
  - Normally performs her own activities of daily living.
- Presented to emergency department (ED) approximately 1.5 hours after reported ingestion of 120 mg of perampanel.
  - Her own medication.
  - On presentation patient was very lethargic with normal vital signs.
  - Physical exam notable for dilated pupils.
  - Patient admitted to intensive care unit (ICU).
  - During ICU course patient was sedated, dizzy and unable to ambulate but was arousable.
  - Patient had no laboratory or vital sign abnormalities.
  - Symptoms resolved over 48 hours.
  - After resolution of lethargy, patient maintained that she had only taken a single acute ingestion of perampanel with no other coingestants.
Should we be concerned about acute unintentional exposures of chloroquine and hydroxychloroquine in children?

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1Maryland Poison Center, University of Maryland School of Pharmacy, Baltimore, MD
2Department of Pediatric Emergency Medicine, University of Maryland School of Pharmacy, Baltimore, MD

Background
- Chloroquine (CQ) and hydroxychloroquine (HCQ) use has increased since the SARS-CoV-2 disease (COVID-19) pandemic
- Deaths have been reported with CQ doses as low as 27 mg/kg in children
- No formal evaluation has been completed assessing risk of severe outcomes and death with acute unintentional exposure to CQ/HCQ compounds

Objectives
- Primary: Describe clinical effects and outcomes of acute unintentional CQ/HCQ exposures
- Secondary: Investigate if a dose response relationship exists for the purpose of triaging

Methods
- Retrospective observational study of acute unintentional ingestions of CQ and HCQ from 2000 – 2019 in children <6 years reported to the National Poison Data System
- Weights if unavailable, were imputed according to the following formula: 7.2701+(0.2561 x age (months)–(0.0015657 x age(months)-23.677)^2)
- Weight based dose calculations were computed using CQ base activity
  - HCQ 200 mg = 155 mg CQ base
  - CQ 250 mg = 150 mg CQ base
- Comparisons between CQ and HCQ utilized Chi square, Fisher’s Exact, or Mann-Whitney U tests

Results

<table>
<thead>
<tr>
<th>Demographics</th>
<th>All Patients N = 1143</th>
<th>CQ N = 120</th>
<th>HCQ N = 1023</th>
<th>*p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age, median (IQR)</td>
<td>2 (1.5 - 2)</td>
<td>2 (1.7 - 3)</td>
<td>2 (1.5 - 2)</td>
<td>0.024</td>
</tr>
<tr>
<td>Male, n (%)</td>
<td>580 (50.7)*</td>
<td>59 (49.2)*</td>
<td>521 (50.9)</td>
<td>0.825</td>
</tr>
<tr>
<td>Weight (kg), median (IQR)</td>
<td>N = 893</td>
<td>N = 88</td>
<td>N = 805</td>
<td>N = 1145</td>
</tr>
<tr>
<td>(10.9 – 14.6)</td>
<td>(11.4 – 15.9)</td>
<td>(11.4 – 15.9)</td>
<td>0.149</td>
<td></td>
</tr>
<tr>
<td>Weight (kg) imputed, median (IQR)</td>
<td>13.4</td>
<td>13.4</td>
<td>13.3</td>
<td>0.108</td>
</tr>
<tr>
<td>(11.4 – 14.1)</td>
<td>(11.4 – 15.9)</td>
<td>(11.4 – 14.1)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Dose Ingested (mg/kg CQ base), median (IQR)</td>
<td>N = 893</td>
<td>N = 88</td>
<td>N = 805</td>
<td>&lt;0.001</td>
</tr>
<tr>
<td>9.7</td>
<td>6.4</td>
<td>9.9</td>
<td></td>
<td></td>
</tr>
<tr>
<td>(5.7 – 13.6)</td>
<td>(4.0 – 10.1)</td>
<td>(6.1 – 13.6)</td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Management site, n (%)</th>
<th>On site (home)</th>
<th>Already in HCF</th>
<th>Referred by PCC to HCF</th>
<th>Other</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 883</td>
<td>251 (28.6)</td>
<td>329 (37.8)</td>
<td>516 (45.1)</td>
<td>5 (0.4)</td>
</tr>
<tr>
<td>N = 88</td>
<td>31 (25.8)</td>
<td>41 (34.2)</td>
<td>48 (40.0)</td>
<td>4 (3.5)</td>
</tr>
<tr>
<td>N = 805</td>
<td>262 (25.6)</td>
<td>288 (28.2)</td>
<td>468 (45.7)</td>
<td>5 (0.5)</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Medical outcome, n (%)</th>
<th>No effect</th>
<th>Minor effect</th>
<th>Moderate effect</th>
<th>Major effect</th>
</tr>
</thead>
<tbody>
<tr>
<td>N = 894</td>
<td>804 (96.1)</td>
<td>103 (12.3)</td>
<td>113 (13.0)</td>
<td>22 (1.9)</td>
</tr>
<tr>
<td>N = 88</td>
<td>100 (88.2)</td>
<td>17 (18.2)</td>
<td>113 (13.0)</td>
<td>4 (3.9)</td>
</tr>
<tr>
<td>N = 805</td>
<td>804 (96.4)</td>
<td>18 (2.2)</td>
<td>113 (13.0)</td>
<td>4 (3.9)</td>
</tr>
</tbody>
</table>

Discussion & Conclusions
- Acute unintentional exposures to CQ and HCQ can be serious, but severe outcomes are uncommon
- CQ appears to be more toxic than HCQ
- A dose effect relationship could not be established

(1) *p value (2) Minor/No Effect
(3) Moderate/Major Effect

*2 unknown sex

<table>
<thead>
<tr>
<th>Clinical Effects</th>
<th>CQ N = 120</th>
<th>HCQ N = 1023</th>
<th>Mod-Major N = 26</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acidosis</td>
<td>-</td>
<td>1 (0.1)</td>
<td>1 (0.6)</td>
</tr>
<tr>
<td>ADR to treatment</td>
<td>1 (0.83)</td>
<td>2 (0.2)</td>
<td>1 (0.83)</td>
</tr>
<tr>
<td>Arrival</td>
<td>-</td>
<td>1 (0.1)</td>
<td>1 (0.83)</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>-</td>
<td>2 (0.2)</td>
<td>2 (0.6)</td>
</tr>
<tr>
<td>Conduction disturbance</td>
<td>-</td>
<td>3 (0.29)</td>
<td>3 (0.29)</td>
</tr>
<tr>
<td>Drowsiness</td>
<td>8 (0.78)</td>
<td>2 (0.2)</td>
<td></td>
</tr>
<tr>
<td>Electrolyte abnormality</td>
<td>1 (0.83)</td>
<td>3 (0.29)</td>
<td>4 (0.78)</td>
</tr>
<tr>
<td>Hypotension</td>
<td>1 (0.83)</td>
<td>2 (0.2)</td>
<td>3 (0.29)</td>
</tr>
<tr>
<td>Respiratory depression</td>
<td>1 (0.83)</td>
<td>-</td>
<td>1 (0.83)</td>
</tr>
<tr>
<td>Seizure (single)</td>
<td>-</td>
<td>1 (0.1)</td>
<td>1 (0.83)</td>
</tr>
<tr>
<td>Seizures (multi/discrete)</td>
<td>1 (0.83)</td>
<td>-</td>
<td>1 (0.83)</td>
</tr>
<tr>
<td>Tachycardia</td>
<td>2 (1.7)</td>
<td>9 (0.88)</td>
<td>4 (0.78)</td>
</tr>
<tr>
<td>V. tachycardia/V. fibrillation</td>
<td>-</td>
<td>1 (0.1)</td>
<td>1 (0.83)</td>
</tr>
<tr>
<td>Vomiting</td>
<td>8 (0.67)</td>
<td>68 (6.65)</td>
<td>7 (0.26)</td>
</tr>
</tbody>
</table>

*2 unknown sex

North American Congress of Clinical Toxicology
Perampanel was approved in 2012 for use in adults with partial onset seizures. It has a unique mechanism inhibiting glutamate activity on AMPA (alpha-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid) receptors. Few published case reports describing acute overdose. Reported symptoms included prolonged central nervous system depression, respiratory depression, and aggressive behavior requiring chemical and physical restraints. Approval indications were expanded in 2018 to include other epilepsy disorders and for use in younger children increasing availability. Normal therapeutic dosing for adults/pediatrics is 2 – 12 mg/day.

**Background**
- Perampanel was approved in 2012 for use in adults with partial onset seizures.
- It has a unique mechanism inhibiting glutamate activity on AMPA (alpha-amino-3-hydroxy-5-methyl-4-isoxazole propionic acid) receptors.
- Few published case reports describing acute overdose.
- Reported symptoms included prolonged central nervous system depression, respiratory depression, and aggressive behavior requiring chemical and physical restraints.
- Approval indications were expanded in 2018 to include other epilepsy disorders and for use in younger children increasing availability.
- Normal therapeutic dosing for adults/pediatrics is 2 – 12 mg/day.

**Objectives**
- Primary: Describe clinical effects and outcomes of perampanel exposures.
- Secondary: Investigate if a dose response relationship exists.

**Methods**
- Retrospective observational study of all single-substance perampanel ingestions from January 2014 to December 2019 reported to NPDS.

**Results**
- Perampanel cases have increased; drowsiness, agitation, ataxia, and confusion were the most reported symptoms and almost 4% of patients received potentially life-saving interventions.
- There were too few reported doses to assess for any correlation – the lowest dose that caused moderate effects was 2 mg in a 21-year-old.

**Conclusion**

**Most Common Symptoms**
- Nausea
- Vomiting
- Tachycardia
- Other - Miscellaneous
- CNS Depression (Mild)
- Dizziness/vertigo
- Confusion
- Ataxia
- Agitation
- Drowsiness/lethargy

**Total Cases: 138**

**Most Common Therapies**
- Intubation
- Oxygen
- Other
- Sedation (other)
- Dilute/irrigate/wash
- Benzodiazepines
- Fluids, IV

**Demographics**
- Age, median (IQR)
- Sex, male, n (%)
- Dose ingested (mg), median (IQR)
- Reason for Exposure
- Management site, n (%)
- Medical outcome, n (%)
- Level of care, n (%)

**Reason for Exposure**
- Unintentional – Therapeutic Error
- Unintentional general
- Unintentional misuse
- Intentional – SI
- Intentional Misuse
- Intentional – Unknown
- ADR
- Unknown/Other

**Management site**
- On site (home)
- Already in HCF
- Referred by PCC to HCF
- Other

**Medical outcome**
- No effect
- Minor effect
- Moderate effect
- Major effect
- Not followed, judged as non-toxic
- Not followed, minimal clinical effects
- Unable to follow, potentially toxic
- Unrelated

**Level of care**
- N=72
- Critical care unit
- Non-critical care unit (floor)
- Psychiatric Facility
- Treated/evaluated and released (FER)
- Left AMA/refused transport

**Number of Cases**

<table>
<thead>
<tr>
<th>Year</th>
<th>Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>2014</td>
<td>27</td>
</tr>
<tr>
<td>2015</td>
<td>20</td>
</tr>
<tr>
<td>2016</td>
<td>13</td>
</tr>
<tr>
<td>2017</td>
<td>12</td>
</tr>
<tr>
<td>2018</td>
<td>11</td>
</tr>
<tr>
<td>2019</td>
<td>7</td>
</tr>
</tbody>
</table>
What is the clinical course of severe benzonatate poisonings?

Faisal Syed Minhaj, Pharm.D.; James Leonard, Pharm.D., DABAT; Maryland Poison Center, University of Maryland School of Pharmacy, Baltimore, MD

**Background**
- Benzonatate is a commonly prescribed cough medication with over 3 million prescriptions per year in 2016.
- Acute overdose of a small number of capsules is potentially lethal.
- This is a descriptive study using the National Poison Data System (NPDS) fatalities module in combination with a systematic review.

**Objectives**
- Primary: Describe the course of severe poisoning and deaths from benzonatate.

**Methods**
- NPDS was queried from 2000–2018 for benzonatate fatalities and fatality abstracts were obtained including relative contribution to fatality.
- Literature search:
  - Independent searches of PubMed, Cochrane, Embase, and Google Scholar were performed for combinations of benzonatate and “poisoning”, “overdose”, or “toxicity”.
  - References from relevant articles were also examined.
- Inclusion: describe the clinical course of ≥1 patient suffering from benzonatate poisoning.
- Both authors independently reviewed titles/abstracts for inclusion and extracted data.
- Discrepancies were resolved through discussion.

**Conclusion**
Acute ingestions of benzonatate cause significant toxicity with a rapid onset of effect and have severe neurologic injury in those resuscitated.

**Results**

<table>
<thead>
<tr>
<th>Treatments Performed</th>
<th>All Patients (n=36)</th>
<th>Survived (n=13)</th>
<th>Died (n=23)</th>
</tr>
</thead>
<tbody>
<tr>
<td>CPR</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Intubation</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Vasopressors</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV fluids</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Sodium Bicarbonate</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>IV lipid emulsion</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Activated charcoal</td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Gastric lavage</td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>

### Onset of Toxicity

- **< 5 minutes**
- **≤ 30 minutes**
- **> 30 minutes**
- **Unknown**

### Treatment Performance

- **Total**
- **Died**
- **Survived**

<table>
<thead>
<tr>
<th>Time (min)</th>
<th>Number of Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>0-5</td>
<td>Total</td>
</tr>
<tr>
<td>6-30</td>
<td>Survived</td>
</tr>
<tr>
<td>&gt; 30</td>
<td>Died</td>
</tr>
<tr>
<td>Unknown</td>
<td></td>
</tr>
</tbody>
</table>
Triprolidine pediatric exposures reported to United States poison centers: 2000-2019 – Save yourself a ‘trip’ to the emergency department

Robert Miller, PharmD & Shawn Varney, MD
The University of Texas Health – San Antonio, & South Texas Poison Center, San Antonio, TX

Background

• Triprolidine is a first-generation antihistamine that features a fast onset of action and short duration.
• Therapeutic errors or exploratory ingestions often result in hospital evaluation due to concern for antihistaminic and anticholinergic toxic effects.
• There is little formal guidance for poison specialists to use as criteria for home management, hospital referral, or disposition.
• The study objective was to use a national poison database to describe the outcomes of pediatric exposures to triprolidine formulations.

Methods

• This study describes pediatric (5 years and younger) single-substance exposures of liquid triprolidine formulations reported to US poison control centers during 2001 to 2019 from the National Poison Data System (NPDS).
• This includes unintentional misuse, general, and therapeutic error exposures.
• The distribution of cases was determined for various factors relating to patient demographics, exposure circumstances, management, and outcome.
• We used descriptive statistics to analyze the data.

Results

<table>
<thead>
<tr>
<th>Exposures (n=1045)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Unintentional: General</td>
</tr>
<tr>
<td>Unintentional: Therapeutic Error</td>
</tr>
<tr>
<td>Unintentional: Misuse</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Chronicity</th>
</tr>
</thead>
<tbody>
<tr>
<td>Acute</td>
</tr>
<tr>
<td>Acute-on-Chronic</td>
</tr>
<tr>
<td>Chronic</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Children</th>
</tr>
</thead>
<tbody>
<tr>
<td>Age 0-2</td>
</tr>
<tr>
<td>Female</td>
</tr>
<tr>
<td>Wt</td>
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</tbody>
</table>

<table>
<thead>
<tr>
<th>Exposure &amp; management site</th>
</tr>
</thead>
<tbody>
<tr>
<td>Exposure at a residence</td>
</tr>
<tr>
<td>Managed on site</td>
</tr>
<tr>
<td>Already en-route to or at a HCF</td>
</tr>
<tr>
<td>Referred to a HCF by PCC</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Disposition (from HCF)</th>
</tr>
</thead>
<tbody>
<tr>
<td>LTFU</td>
</tr>
<tr>
<td>Admission</td>
</tr>
<tr>
<td>Evaluated, treated, and released</td>
</tr>
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</table>

<table>
<thead>
<tr>
<th>Outcomes</th>
</tr>
</thead>
<tbody>
<tr>
<td>Followed to a known outcome</td>
</tr>
<tr>
<td>No effect</td>
</tr>
<tr>
<td>Minor</td>
</tr>
<tr>
<td>Moderate</td>
</tr>
<tr>
<td>Not followed or lost to follow-up</td>
</tr>
<tr>
<td>Minimal or no toxic effects anticipated</td>
</tr>
<tr>
<td>Unable to follow</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Clinical Effects</th>
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</thead>
<tbody>
<tr>
<td>Cardiovascular: Tachycardia</td>
</tr>
<tr>
<td>Neurological</td>
</tr>
<tr>
<td>Gastrointestinal: Nausea &amp; vomiting</td>
</tr>
<tr>
<td>Other</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Neurological Effects</th>
</tr>
</thead>
<tbody>
<tr>
<td>Minor CNS depression</td>
</tr>
<tr>
<td>Anxiety</td>
</tr>
<tr>
<td>Agitation</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Interventions</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snack/food</td>
</tr>
<tr>
<td>Dilution with fluids</td>
</tr>
<tr>
<td>Single-dose activated charcoal</td>
</tr>
<tr>
<td>IV fluids</td>
</tr>
<tr>
<td>Benzodiazepines</td>
</tr>
</tbody>
</table>

Limitations

• Using the NPDS is subject to the standard limitations of performing a retrospective chart review
• Clinical effects are often subjective; for example, a child being “fussy” is often described as agitation.

Conclusions

• Most reported triprolidine exposures (93.8%) resulted in no effects, minimal effects possible, or unrelated effects, with drowsiness being the most frequently reported clinical effect. There were no seizures, arrhythmias, or fatalities.
• No patient required aggressive intervention; seven of eight admitted patients were asymptomatic, and all patients recovered with no clinical sequelae; yet over 28% of exposures were managed in a HCF.
• Triprolidine appears to be a safe medication that allows home observation after exposure.
INTRODUCTION

Essential oils (EOs) are concentrated plant extracts used for medicinal, cleaning, and other household purposes and are among the top 20 substance categories most frequently involved in pediatric exposures reported to US poison centers. There is a common misconception that EOs are safe by virtue of being “natural,” although many may be toxic when misused.

The study has two specific aims:

Aim 1: To describe the epidemiology of essential oil exposures over a ten-year period in pediatric and adult populations

Aim 2: To compare medical outcomes across EO types

METHODS

This retrospective cohort study investigated EO exposures reported to the National Poison Data System from January 1, 2009 to December 31, 2018.

Cases were identified using EO generic codes. Products were categorized into EO type and the ten most common EO types were analyzed. The following cases were excluded:

- Cases with unspecified or multiple products
- Cases with unknown age
- Confirmed non-exposures

Cases were analyzed by route, exposure reason, and medical outcome for pediatric (<12 years of age) and adult (≥12 years of age) populations. For cases followed to a known outcome, outcomes were collapsed into 3 categories:

1. No or Unrelated Effect
2. Minor Effect
3. Clinically Significant Effect (Moderate Effect, Major Effect, or Death)

Outcomes were compared by EO type for both age groups using Chi-Square tests.

RESULTS

Cases involving the ten most common EOs (n=98,485) accounted for 73.6% of all EO exposures and included tea tree, eucalyptus, peppermint, cinnamon, clove, lavender, allspice, combination, lemon, and lemongrass oils. The majority of cases (73.0%) were pediatric. Most pediatric cases (94.6%) were unintentional-general exposures, while unintentional-misuse (34.6%) and unintentional-general (34.1%) were the most common exposure reasons in adults. The most common route was ingestion for pediatric (88.6%) and adult (69.4%) cases.

Severity of outcome varied significantly by EO type for both age groups (p<0.001). Eucalyptus (2.6%), peppermint (2.6%), and cinnamon (2.3%) oil exposures had the highest proportion of clinically significant outcomes in pediatric cases (Table 1). Cinnamon (10.0%), clove (9.4%), and lemongrass (8.9%) had the highest proportion of clinically significant outcomes in adults (Table 2).

CONCLUSIONS

A total of 98,495 single product exposures involving the ten most common EOs were reported to US poison centers over a ten-year period, with the majority involving children <12 years.

While most exposures involved no or unrelated effects or were not followed to a known outcome, adult exposures and some types of EOs involved a higher proportion of clinically significant outcomes. These differences suggest that some EOs may pose a different risk, and further investigation into the safety of specific products may be warranted.

LIMITATIONS

EO generic codes may include substance formations other than liquids.
INTRODUCTION
Timely crotalidae polyvalent immune Fab (FabAV) administration is recommended after clinically significant Crotaline envenomation, with the immediate goal of achieving initial control (IC) of signs and symptoms of envenomation. Few studies have examined whether time to treatment after envenomation affects the achievement of IC. Yin et al found that time to treatment was not a significant factor in difficulty achieving initial control, and Anderson et al found that early time to treatment led to faster overall recovery after copperhead envenomation.

The purpose of this study was to examine the association between time to treatment after envenomation and initial control. This study had two specific aims:

Aim 1: To determine whether time to treatment after Crotaline envenomation predicts the dose of antivenom required to achieve IC

Aim 2: To determine whether receiving treatment within six hours of envenomation increased the odds of achieving IC with the first dose of FabAV.

METHODS
A retrospective cohort study was conducted using data collected prospectively from three US regional poison centers:

1. Rocky Mountain Poison Center (RMPC)
2. Louisiana Poison Control Center (LPCC)
3. Oklahoma Center for Poison & Drug Information (OCPDI)

Cases were included if the subject was envenomated by a rattlesnake, copperhead, cottonmouth, or unknown Crotaline snake and treated with FabAV. Cases with unknown time of snakebite, time of first FabAV dose, or number of vials of antivenom used to achieve IC were excluded.

Aim 1: Linear regression was used to model the relationship between time to treatment after envenomation and the dose of antivenom used to achieve IC of venom effects, adjusting for age, sex, and snake type.

Aim 2: Fisher’s exact test was used to test the association between receiving treatment within 6 hours of envenomation and achievement of IC with the first dose of FabAV.

RESULTS
A total of 51 cases were included in analysis. The majority were male (n=34, 66.7%), and mean subject age was 36.5 years (SD: 22.9 years). The majority were bitten by rattlesnakes (n=19), followed by copperheads (n=15), unknown Crotaline snakes (n=11), and cottonmouths (n=6). Most cases came from LPCC (n=27, 52.9%), followed by RMPC (n=21, 41.2%) and OCPDI (n=3, 5.9%).

An average of 6.65 vials (SD: 2.83 vials) of FabAV was required to achieve IC, ranging from 4-14 vials. Mean time to treatment was 4.35 hours (SD: 3.56 hours), ranging from 0.60-15.52 hours. After adjusting for covariates, no significant association between time to treatment and antivenom required to achieve IC was observed (p=0.41).

Patients treated after 6 hours of envenomation were as likely to achieve IC with the first dose of antivenom as those treated within 6 hours (80.0% and 64.3% of patients, respectively; OR=0.45, 95% CI 0.08, 2.40; p=0.47).

CONCLUSIONS
No association was observed between time to antivenom treatment after Crotaline envenomation and amount of antivenom used to achieve IC. No association was observed between receiving antivenom treatment within 6 hours of envenomation and the achievement of IC with the first dose of antivenom.

These findings suggest that time to treatment after Crotaline envenomation may not significantly impact the ability to gain initial control of signs and symptoms with FabAV. Follow-up analyses with a larger sample should be performed to understand the factors associated with achieving IC, including time to antivenom treatment. Furthermore, future studies should be conducted to model the effect with other antivenom types, including Crotalidae Immune F(ab’)2.

LIMITATIONS
This study was limited by small sample size. Additionally, this study did not control for other factors that may influence outcomes such as venom load or bite location. Finally, this study did not examine other outcomes that are known to be improved by early treatment, such as limb function.
### Background
- Baclofen is a GABA B agonist prescribed in adults as adjunctive therapy for musculoskeletal pain and in pediatric patients for management of spasticity.
- Dosing of oral baclofen solutions can be confusing to caregivers and may lead to inadvertent overdoses.

### Case Report (continued)
- The patient was admitted to the PICU on nasal BiPAP (which was his baseline), with normal respiratory drive and oxygen saturations.
- Following admission, he developed bradypnea requiring transition to BiPAP with full face mask and placement of an oropharyngeal airway.
- He gradually returned to baseline over the next 2 days and was transferred out of the PICU.
- Baclofen was subsequently restarted, and dosing instructions were reviewed carefully with the mother.
- Baclofen level was drawn at presentation and returned markedly elevated at 1.3 mcg/mL (therapeutic range 0.08-0.4 mcg/mL).

### Discussion
- Baclofen is a GABA B agonist that is prescribed in pediatric patients for management of spasticity.
- Due to the presence of both presynaptic and postsynaptic GABA B receptors, patients can present with both agitation and sedation in overdose, however in massive overdose sedation tends to predominate.
- Our patient developed bradypnea requiring more aggressive ventilatory support with full facemask BiPAP and an oropharyngeal airway, but otherwise he had a benign clinical course.
- The formulations and dosing regimens of baclofen can be confusing to caregivers, and providers should ensure that this is reviewed to avoid inadvertent overdoses in the outpatient setting.

### Conclusion
- Baclofen is regularly prescribed for management of spasticity in some pediatric patients and confusion regarding dosing can result in inadvertent overdoses.
- We highlight the case of a massive baclofen overdose in a pediatric patient due to a dosing error who required PICU admission for observation and respiratory support.
### Background
- Methanol is a toxic alcohol that can result in significant morbidity and mortality.
- The typical exposure route is via ingestion, however significant exposures via inhalation are reported.
- Toxicity specifically secondary to lacquer thinner huffing has been described.

### Case Report
- This is a single patient case report.
- 54 yo M w/ PMHx of alcohol and inhalant use disorders presented to the ED with chest pain.
- He endorsed lacquer thinner huffing, with safety data sheet (SDS) notable for methanol, toluene, acetone, and 2-butoxyethanol.
- Initial blood work revealed a bicarbonate level of 15 mMol/L, an anion gap of 19.5 mEq/L (normal 7-15), an undetectable ethanol level, and a normal creatinine.

### Case Report (continued)
- Fomepizole was empirically administered.
- Code was called overnight for depressed mental status and patient was transferred to the ICU.
- The next morning, methanol level returned elevated at 124 mg/dL with an acetone level of 37 mg/dL.
- The patient underwent 7 hours of continuous hemodialysis until methanol level was 20 mg/dL.
- Fomepizole was continued throughout hemodialysis.
- Methanol level was undetectable the following day and the patient developed no adverse sequelae from his exposure.

### Discussion
- Unlike other toxic alcohols, methanol can result in systemic toxicity from inhalational exposure.
- Methanol toxicity via inhalation has been well documented in both the recreational and occupational setting due to exposure to fumes of industrial solvents, particularly carburetor cleaners.
- Treatment is the same as for methanol toxicity due to ingestion, with focus on inhibition of alcohol dehydrogenase and hemodialysis.

### Conclusion
- Huffing methanol products can lead to significant methanol levels requiring fomepizole and hemodialysis.
- Scrutiny of a product’s SDS is important to exclude methanol exposure.
- Providers should be aware that patients huffing these products need careful evaluation as they can have delayed toxicity.
Background
- There are two species of oleander
- The common pink and the yellow oleander
- The whole plant is poisonous
- The symptoms of oleander poisoning include nausea, vomiting, abdominal pain, dizziness, slow pulse, irregular heartbeat, dilation of the pupils, diarrhea, drowsiness, and coma
- Deaths have been reported with oleander ingestion, and the plant has been used to commit attempted murder and suicide
- The objective of this study was to describe attempted suicides involving oleander reported to poison centers

Methods
- Cases were oleander ingestions reported to a large, statewide poison center network during 2000-2018 where the exposure reason was intentional-suicide
- Ingestions involving substances in addition to oleander were excluded
- The distribution of cases was determined for various factors related to patient demographics, exposure circumstances, management, and outcome

Results
- Fifty-five oleander ingestions met the study criteria.
- The plant part ingested was 30 (54.5%) leaf, 3 (5.5%) flower, 1 (1.8%) bark, 1 (1.8%) seed, 2 (3.6%) multiple parts, and 18 (32.7%) unknown.

Results Cont.
- The mean patient age was 39 years (range 14-74 years)

Table 1. Most Common Adverse Events

<table>
<thead>
<tr>
<th>Adverse Event</th>
<th>Number of Patients</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Vomiting</td>
<td>17</td>
<td>30.9%</td>
</tr>
<tr>
<td>Nausea</td>
<td>14</td>
<td>25.5%</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>7</td>
<td>12.7%</td>
</tr>
<tr>
<td>Abdominal Pain</td>
<td>5</td>
<td>9.1%</td>
</tr>
<tr>
<td>Drowsiness/lethargy</td>
<td>5</td>
<td>9.1%</td>
</tr>
</tbody>
</table>

- The most frequently reported treatments were IV fluids (n=20, 36.4%), activated charcoal (n=22, 40.0%), cathartic (n=10, 18.2%), and antiemetic (n=7, 12.7%).

Discussion
Most of the patients who attempted suicide with oleander were in their 30s-40s and male. Leaves were the most frequently reported plant part used. Almost half (49%) of the cases resulted in serious outcomes, including 2 deaths.
Slime product-related injuries managed at emergency departments
Anelle Menendez\textsuperscript{a}, Donna Abron\textsuperscript{a} Mathias B. Forrester\textsuperscript{b}
\textsuperscript{a}North Texas Poison Center, Dallas, TX, USA, \textsuperscript{b}Independent Researcher, Austin, TX, USA

Background
- Homemade slime is promoted as a substance that can be produced by children at home or at school
- Homemade slime’s increased popularity have been reports of injuries when making or playing with the substance.
- The objective of this study was to describe slime product exposures reported to United States (US) emergency departments (EDs).

Methods
- Data were obtained from the National Electronic Injury Surveillance System (NEISS)
- Slime product-related injuries reported during 2001-2018 were identified by searching the database’s two narrative text fields for any mention of “slime” and reviewing the resulting records to determine whether the substance involved in the injury appeared to be a slime product
- The distribution of slime product-related injuries was determined for various factors related to patient demographics, injury circumstances, diagnosis, and disposition.

Results
- The distribution of the cases by route was 43 (54.4%) dermal, 15 (19.0%) ingestion, 10 (12.7%) ocular, 7 (8.9%) otic, 1 (1.3%) inhalation, and 3 (3.8%) unknown route.
- Nineteen (24.1%) of the patients were age 5 years or younger, 52 (65.8%) 6-12 years, 3 (3.8%) 13-19 years, and 5 (6.3%) 20 years or older; 64 (81.0%) of the patients were female and 15 (19.0%) were male.
- Seventy-five (94.9%) of the patients were treated and released from the ED and 4 (5.1%) left without being seen.

Conclusion
- Slime product injuries reported to the NEISS increased greatly in 2017 and even more so in 2018.
- The exposures were most like to occur by dermal, ingestion, and ocular routes and occur at home or in school.
- Patients tended to be children and female and did not need to be admitted to a healthcare facility.
- Continued surveillance of ED data may be useful to determine whether interest in homemade slime, and the injuries that may result from its production and use, will continue or wane over time.
Background

- Crotalidae polyvalent immune fab (ovine) (Crofab®) is a sheep derived antivenin indicated for the management of patients with envenomation by North American crotalids (rattlesnakes, copperheads, cottonmouths/water moccasins), which can cause serious morbidity and even death.
- The most common adverse effects reported with Crofab include urticaria, rash, pruritus, nausea, and back pain.
- Severe allergic reactions (hives and a rash and pruritus) and recurrent coagulopathy may also occur.
- The objective of this study was to describe Crofab adverse events reported to the United States Food and Drug Administration (FDA).

Methods

- Data were obtained from the FDA Adverse Reporting System (FAERS).
- The FAERS public dashboard was searched for all records added during January 1, 2001-September 30, 2019 that reported Crofab or Crotalidae polyvalent immune fab (ovine), and the raw data for the records were downloaded.
- Cases involving exposure to other substances were included.
- The distribution of Crofab adverse events was determined for various factors related to patient demographics, circumstances of the exposure, symptoms, and outcome.

Results

- A total of 479 Crofab adverse events were identified, 62 (12.9%) reported by a consumer, 398 (83.1%) by a healthcare professional, and 19 (4.0%) not specified.
- The reported outcomes were 121 (25.3%) not serious, 6 (1.3%) required intervention, 194 (40.5%) hospitalized, 33 (6.9%) disabled, 72 (15.0%) life threatening, 1 (0.2%) congenital anomaly, 216 (45.1%) other outcomes, and 28 (5.8%) died.

Conclusion

- Almost half of Crofab adverse events occurred in the summer.
- The majority of patients were adult male.
- The most frequently reported adverse reactions were swelling, pain, coagulopathy, rash, and thrombocytopenia.
- The majority of adverse events had serious outcomes. However, these serious outcomes, including deaths, were not necessarily related to the Crofab.
Kratom (mitragynine) adverse events reported to the Food and Drug Administration

Anelle Orlando Llerena a, Mathias B. Forrester b
A North Texas Poison Center, Dallas, TX, USA, B Independent Researcher, Austin, TX, USA

Background
- Kratom (Mitragyna speciosa) is a tropical tree that contains compounds that can have opioid-like effects
- Mitragynine, an alkaloid abundant in kratom, is considered to be primarily responsible for its effects
- People use kratom as a substitute for opium and to treat the symptoms of opioid withdrawal
- The objective of this study was to describe kratom adverse events reported to the US Food and Drug Administration (FDA)

Methods
- Data were obtained from the FDA Adverse Reporting System (FAERS)
- The FAERS public dashboard was searched for all records added during January 1, 2008-September 30, 2019 that reported mitragynine (kratom), and the raw data for the records were downloaded
- Cases involving exposure to other substances were included in the analyses of the patient demographics but excluded from the analyses of symptoms and outcome

Results
- A total of 472 kratom adverse events were identified, 98 (20.8%) reported by a consumer, 202 (42.8%) by a healthcare professional, and 172 (36.4%) other/not specified.

Results Cont.
- The mean patient age was 34 years

Of these 197 cases, the most frequently reported adverse reactions were 28 (14.2%) toxicity to various agents, 19 (9.6%) drug dependence, 19 (9.6%) vomiting, 12 (6.1%) nausea, 10 (5.1%) diarrhea, and 8 (4.1%) seizure.

Conclusion
- Most of the kratom adverse event occurred since 2017
- The majority of patients were male and age 20-39 years
- Most adverse events involving only kratom had serious outcomes
- These serious outcomes, including deaths, were not necessarily related to the kratom.
Positive benefits reported for air fresheners include ameliorating the adverse effects of noxious odors while improving mood, reducing stress, and enhancing memory (Johnson, et al.). However, survey and surveillance data report that susceptible individuals may have adverse reactions to air freshener exposure, including induction or exacerbation of asthma and other respiratory complaints (Ternesten-Hasséus, et al., Weinberg JL, et al.). Development of a mouse model of fragrance induced airway hyper-reactivity will help elucidate the mechanism of air fresheners in exacerbating asthma, and provide a platform for identifying which specific chemicals in air fresheners are most likely to produce bronchial hyper-reactivity in susceptible humans such as those with asthma.

**INTRODUCTION**

**RESULTS**

In both strains of mice, there was no significant difference in Newtonian airflow resistance between air freshener-exposed and air control groups at baseline and after PBS aerosol challenge, although BALB/cByJ mice showed slightly elevated values with exposure to air freshener. However, air freshener-exposed BALB/cByJ mice showed a significant increase in airflow reactivity to ACh over air controls, while exposed C57BL/6J mice had only a small increase (Figure 1). The average Newtonian resistance values for each strain and exposure group at baseline, and after PBS and ACh aerosol challenges are shown in Figure 1. Newtonian resistance after ACh challenge was significantly higher in the BALB/cByJ versus C57BL/6J mice (p<0.04) exposed to air freshener.

**CONCLUSIONS**

Exposure to the air freshener produced increases in Newtonian airflow resistance with ACh challenge in the exposed groups, that was statistically significant for the BALB/cByJ strain of mice.

**REFERENCES**

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**ACKNOWLEDGEMENT**

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The Social Networkingman's Blues: Sodium Nitrite as a Method of Suicide Prescribed by Online Communities

McCann, Sean1; Tweet, Marit1; Kennedy, Joseph1; Black, Elizabeth1; Bryant, Sean1

Background
• Sodium nitrite is a water-soluble salt used in meat curing
• Highly pure granular preparations are inexpensive and available in large quantities available on large mainstream online marketplaces
• We describe a case series of four patients with severe methemoglobinemia secondary to sodium nitrite ingestion managed by our regional poison center.

Case 1
A 24-year-old male presented to the ED via EMS with cyanosis approximately 45 minutes after intentional ingestion of one cup of sodium nitrite powder. He had with him a 2-pound bottle of sodium nitrite purchased from a large, commonly used online marketplace. Methylene blue was administered and over the next hour the patient had several episodes of hypotension with systolic blood pressures as low as 80 mmHg. His cyanosis resolved and a repeat MetHb level one hour after treatment was 10.5%. He was observed overnight with no re-occurrence of methemoglobinemia. He chose sodium nitrite as a method of suicide based on recommendations from a social media page intended as a support group for individuals with depression.

Case 2
A 35-year-old male attempted suicide by ingesting sodium nitrite. EMS found him alert, cyanotic, and in respiratory distress. During transport he became unresponsive and asystolic. Two doses of methylene blue 1mg/kg (75mg) were administered, however, the second dose infiltrated leading to a third dose of 50mg. His blood was described as very dark but a sample adequate for laboratory evaluation was not obtained. Resuscitative efforts were terminated after one hour.

Case 3
A 17-year-old female presented “pale and cyanotic” to the ED 1.5 hours after ingesting 21g sodium nitrite which she purchased over the internet. Additionally, she ingested a half bottle of bismuth subsalicylate to prevent abdominal discomfort or emesis based on recommendations found online. She received one dose of methylene blue and improved over the next hour. Repeat MetHb level two hours post treatment was 5%. She was observed overnight with no re-emergence of methemoglobinemia or evidence of salicylate poisoning.

Case 4
A 24-year-old male presented to the ED via EMS with cyanosis approximately 45 minutes after intentional ingestion of one cup of sodium nitrite powder. He had with him a 2-pound bottle of sodium nitrite purchased from a large, commonly used online marketplace. Methylene blue was administered and over the next hour the patient had several episodes of hypotension with systolic blood pressures as low as 80 mmHg. His cyanosis resolved and a repeat MetHb level one hour after treatment was 10.5%. He was observed overnight with no re-occurrence of methemoglobinemia. He chose sodium nitrite as a method of suicide based on recommendations from a social media page intended as a support group for individuals with depression.

Conclusions
• Intentional ingestion of sodium nitrite is a contemporary method of suicide being recommended on the internet.
• It can result in severe methemoglobinemia capable of causing significant morbidity and mortality and is highly responsive to antidotal therapy if treated early.
Impact of 2018 FDA Loperamide Packaging Guidelines on Cases Reported to US Poison Centers

McCann, Sean¹; Wahl, Michael²

Background
- Loperamide has been misused or abused to self-treat opioid withdrawal or obtain a euphoric effect
- High dose ingestion is associated with significant toxicity, particularly QT prolongation and cardiac dysrhythmia
- January 2018: United States Food and Drug Administration (FDA) issued an alert advising manufacturers to alter and improve loperamide packaging to a safer form
- Late 2019: FDA formalized changes limiting packages to contain no more than 48 mg with each tablet or pill wrapped in individual doses
- This retrospective observational study of National Poison Database System (NPDS) data evaluates the impact of these regulations on incidence and severity of loperamide abuse and misuse

Methods
- NPDS was queried for all exposures to loperamide:
  - patients aged 6 years and older
  - January 1, 2016 - December 31, 2019
  - coded as abuse, misuse or related to withdrawal
- Data abstracted: patient age, sex, date of exposure, estimated amount of loperamide ingested, identity of co-ingestants, and medical outcome
- Patients who were not followed for outcome or who were lost to follow up were excluded from analysis of outcome distribution but were included in analysis of ingested dose
- Data were analyzed with descriptive statistics

Results
- 1244 cases met inclusion criteria
- 345 were excluded for lack of medical outcome
- Median age: 34 (IQR 27-48, range 6-100)
- The majority of patients (60%) were male
- Exposures peaked in 2017 and fell 32% by 2019
- All medical outcome effects decreased between 2017 and 2019 – minor (25%), moderate (35%), major (37%) and death (33%)
- An estimated average dose of exposure was reported in 852 patients (47.9%) with a decrease of 30% when comparing the peak in 2017 to the low in 2019

Conclusions and Limitations
- Incidence and case severity were relatively similar in 2016 - 2018
- Incidence and mean dose of exposure were observed to decrease in 2018 and 2019 compared to the preceding year
- FDA-imposed limits on loperamide packaging may have contributed to both the decrease in the number of cases reported and total dose of exposure
- Confounding factors may have influenced the observed effects given the limitations of data collected via voluntary reports to poison centers
- Increasing public awareness of the toxicity of high dose loperamide ingestion may have influenced the observed effects
- Further research to monitor the progression of these exposures will be helpful in informing future regulatory policies
Background

• History is often incomplete or unreliable in poisoned patients
• NAC therapy is often empirically initiated based on laboratory findings suggestive of liver injury
• Aspartate aminotransferase (AST) and alanine aminotransferase (ALT) also exist in skeletal muscle
• Several studies report transaminases are commonly elevated in rhabdomyolysis
• Study objective: to examine the incidence of NAC utilization in patients reported to the Illinois Poison Center (IPC) with elevated transaminases secondary to rhabdomyolysis without acetaminophen (APAP) toxicity as compared to APAP-poisoned patients with concomitant rhabdomyolysis

Methods

• IPC records were retrospectively queried for patients treated with NAC from January 1, 2018 – December 31, 2019
• Inclusion criteria: documented creatine kinase (CK) ≥ 1000 U/L, treatment with NAC
• Data Collected: Age, gender, adverse reactions to NAC, and outcome (death or liver transplantation), and highest documented laboratory values of acetaminophen, CK, AST, ALT, total bilirubin, and INR
• Patients were divided into two groups:
  • “No APAP” group: no detectable APAP level and a history not suggestive of acetaminophen exposure
  • “APAP” group: all other cases
• Data were analyzed using descriptive statistics

Results

• 1,958 patients managed by the IPC were treated with NAC during the study period
• 102 patients met inclusion criteria.
• Median age: 45 years (IQR 28-60, range 12-92)
• 50% female, 50% male
• 25 patients (24.5%) met criteria for inclusion in the “no APAP” group.
• “APAP” group: 66 patients with either history of APAP ingestion or detectable APAP level and 11 patients with no detectable APAP but insufficient history to determine that APAP exposure was unlikely.
• No patient in the “no APAP” group had a documented total bilirubin greater than 2 mg/dL or an INR greater than 2, compared to 17 patients in the “APAP” group.
• One patient, in the “no APAP” group, experienced a mild anaphylactoid reaction to NAC, which resolved with diphenhydramine and corticosteroids.
• One patient in the “no APAP” group died after presenting in multisystem organ failure with myocardial injury and cerebral infarcts. Eleven patients (10.8%) died and none required transplantation.
• A comparison of the highest documented laboratory values and ranges between the two groups is presented in Table 1

Conclusions and Limitations

• It is not uncommon for patients with rhabdomyolysis to develop elevated transaminase levels mimicking APAP poisoning
• We observed a high proportion (24.5%) of patients treated with NAC who had elevated CK levels but no historical or laboratory evidence of APAP ingestion
• The median highest documented CK levels in the “no APAP” group was greater than in the “APAP” group
• Higher AST/ALT in the “no APAP” group may be the result of the group definition - the only possible indication for NAC therapy (an inclusion criterion) in this group is abnormal liver enzymes
• Hepatic synthetic dysfunction was not seen in any patient with an undetectable APAP level and a history not suggestive of APAP exposure
• Determination of whether a history is suggestive of APAP exposure is subjective and may limit reproducibility of our results
• Further research is warranted to better describe this phenomenon.

Table 1: Highest documented laboratory values - presented as mean (IQR).

<table>
<thead>
<tr>
<th>Laboratory Value</th>
<th>No APAP</th>
<th>APAP</th>
</tr>
</thead>
<tbody>
<tr>
<td>CK (units/L)</td>
<td>9,194 (2,862 – 17,375)</td>
<td>4,211 (2,292 – 12,818)</td>
</tr>
<tr>
<td>AST (units/L)</td>
<td>1,497 (357 – 4,103)</td>
<td>509 (128 – 2,925)</td>
</tr>
<tr>
<td>ALT (units/L)</td>
<td>1,582 (106 – 2,977)</td>
<td>226 (61 – 1,962)</td>
</tr>
<tr>
<td>Total bilirubin (mg/dL)</td>
<td>0.9 (0.75 – 1.45)</td>
<td>0.7 (0.4 – 1.13)</td>
</tr>
<tr>
<td>INR</td>
<td>1.30 (1.10 – 1.60)</td>
<td>1.4 (1.18 – 1.58)</td>
</tr>
</tbody>
</table>
IS MG/KG A RELIABLE TRIAGE STRATEGY FOR DEXTROMETHORPHAN EXPOSURES IN CHILDREN?

Bergandi Johnson, Theresa Matoushek, Carolyn Odom, Rebecca Tominack, Julie Weber
Missouri Poison Center at SSM Health Cardinal Glennon Children’s Hospital, St. Louis, MO

BACKGROUND

• Dextromethorphan (DXM) is in hundreds of over-the-counter (OTC) medications and is found in many homes.

• Pediatric DXM exposures are common; it is imperative to have a reliable triage strategy to determine appropriate level of care.

• Many poison centers’ maximum tolerated dose (MTD) for ED-referral is >7.5 mg/kg, based on a consensus guideline published in 2007, some have higher MTDs, including our center.

• Objective: Assess the appropriateness of our existing DXM triage strategy (>10 mg/kg immediate-release, >20 mg/kg extended-release) as a guide to recommendations for level of care.

METHODS

• Archived Toxicall® records were searched over a 3-year period (January 2017-December 2019) for accidental pediatric (0-5 years) DXM exposures, with or without expectorant, that were unintentional-general or unintentional-therapeutic error.

• Only cases followed to a known outcome were included in the analysis; unrelated effects were also excluded.

• Patients were divided into 2 groups: Home-Managed and ED-Evaluated (SPI-Refered to ED and Self-Refered to ED).

• Individual symptoms as well as severity of medical outcome (No Effect, Minor, Moderate, Major, and Death) were recorded.

• The amount of DXM ingested in mg/kg was evaluated and exposure scenarios were inspected for insight regarding effect on triage and outcome.

RESULTS

• 193 cases met inclusion criteria:
  o 174 Home-Managed
  o 19 ED-Evaluated (7 SPI-Related and 12 Self-Related)

• DXM dose in mg/kg was calculated in 177/193 (91.7%) cases; many were rough estimates due to spills or other inconsistencies.
  o The overall range of mg/kg DXM varied widely from 0.1 mg/kg to 52.3 mg/kg (median 2.2, IQR 0.8-4.9 mg/kg).

• Most SPI-Related cases had vague/unknown histories of ingestion.

• There were no major outcomes in either group.

• Of the total cases in both groups, 180 (93.3%) had either no effect or only minor outcomes.

• Four patients were admitted to the hospital.

<table>
<thead>
<tr>
<th>Number of Cases</th>
<th>ED-Evaluated</th>
<th>Home-Managed</th>
<th>Total Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>No Effect</td>
<td>19</td>
<td>174</td>
<td>193</td>
</tr>
<tr>
<td>Unrelated Effect</td>
<td>8 (42.1%)</td>
<td>6 (3.4%)</td>
<td>6 (3.1%)</td>
</tr>
<tr>
<td>Total Symptomatic</td>
<td>11 (57.9%)</td>
<td>38 (21.8%)</td>
<td>49 (25.4%)</td>
</tr>
<tr>
<td>Minor Outcome</td>
<td>4 (21.1%)</td>
<td>38 (21.8%)</td>
<td>42 (21.8%)</td>
</tr>
<tr>
<td>Moderate Outcome</td>
<td>7 (36.8%)</td>
<td>38 (21.8%)</td>
<td>4 (3.6%)</td>
</tr>
<tr>
<td>Major Outcome</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
<tr>
<td>Death</td>
<td>0</td>
<td>0</td>
<td>0</td>
</tr>
</tbody>
</table>

Table 1: Medical Outcomes (ED-Evaluated vs Home-Managed)

RESULTS (continued)

<table>
<thead>
<tr>
<th>Most Common Symptoms</th>
<th>ED-Evaluated</th>
<th>Home-Managed</th>
<th>Total Cases</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ataxia</td>
<td>21.8%</td>
<td>57.9%</td>
<td></td>
</tr>
<tr>
<td>Dizziness</td>
<td>16%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Drowsiness</td>
<td>16%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Erythema</td>
<td>16%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Hallucinations</td>
<td>16%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Mydriasis</td>
<td>16%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Nystagmus</td>
<td>16%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Tachycardia</td>
<td>16%</td>
<td>16%</td>
<td></td>
</tr>
<tr>
<td>Vomiting</td>
<td>16%</td>
<td>16%</td>
<td></td>
</tr>
</tbody>
</table>

Table 2: Most Common Symptoms (ED-Evaluated vs Home-Managed)

CONCLUSIONS

• It can be difficult to determine an accurate amount ingested with most pediatric cases; unnecessary ED referrals can be avoided by using clinical expertise instead of worst-case scenario calculations.

• The majority of cases reviewed were benign with no symptoms or only minor outcomes, including those evaluated in the ED.

• The current mg/kg strategy was adequate but DXM triage may be better structured to guide SPIs to observe these cases at home with follow-up at 1 and 3 hours (and also 6 hours if ER formulation), and base ED referral on the development of concerning symptoms.
Respiratory Failure in ED Patients with Confirmed Synthetic Cannabinoid Exposure

Manini AF, Krotulski AJ, Allen L, Hurd YL, Richardson LD, Vidal K, Logan BK

The Icahn School of Medicine at MOUNT SINAI, NMS Labs, Fredric Rieders Family Foundation

Introduction

- Synthetic cannabinoids (SC) are popular, widely-available drugs of abuse that are specifically designed to mimic the desired effects of marijuana.
- The SCs studied to date generally show a greater cannabinoid receptor binding affinity and 2-100 times more potent pharmacologic effects than ∆9-tetrahydrocannabinol, the primary psychoactive compound in marijuana (1).
- However, clinical outcomes following confirmed acute SC overdose are poorly described.
- Previously it was shown that endotracheal intubation after any acute drug overdose occurs in approximately 3.5% of emergency department (ED) patients (2).
- But reports of respiratory compromise following SC drug overdose are limited to uncontrolled small case series which lack toxicological or chemical confirmation (3-4).

Objectives

- We aimed to describe the occurrence of acute respiratory failure (ARF) in ED patients with analytically-confirmed SC exposure.
- The objective was to investigate any association with ARF compared to non-SC overdose patients as controls.

Methods

- **Study Design/Setting**: Observational cohort between 2016-19 at two urban, tertiary-care hospitals.
- **Patients**: All ED visits with acute drug overdose were screened. Patients were included if SC drugs were suspected by treating clinicians (based on chart review). Patients were excluded if (a) there was no waste serum available, (b) age was <18, or (c) prisoners.
- **Protocol**: Waste serum, if available from specimens drawn as part of clinical care, was analyzed for toxicological confirmation of drug use. Samples were stored at −80°C prior to analyte measurement. Clinical data was abstracted by chart review using trained research assistants. The study protocol was approved by the institutional review board with waiver of consent.
- **Measurements**: Instrumental analysis was performed via liquid chromatography/ quadrupole time-of-flight mass spectrometry. The battery of drugs tested for was extensive and included >600 novel psychoactive substances.
- **Primary Outcome**: In-hospital occurrence of ARF was defined as any of the following: (A) tracheal intubation, (B) mechanical ventilation, or (C) naloxone administration.
- **Secondary Outcomes**: (A) adverse cardiovascular events, (B) ED disposition, and (C) in-hospital mortality.
- **Statistical Analysis**: Incidence of clinical outcomes for specific SC drugs and those with confirmed non-SC overdose were calculated with 95% CI and compared using chi-squared test with 5% alpha.

Results

- **Enrollment**: Out of 39 ED patients with suspected SC overdose analyzed, there were 17 confirmed SC exposures (10 single-drug, 7 polydrug) and 22 confirmed non-SC overdoses.
- **SC Drugs**: Confirmed SC drugs are shown in Figure 2.
- **Disposition**: Final ED disposition was the following: 6% ICU; 11% floor; 83% medically cleared for psychiatric evaluation.
- **Outcomes**: Overall incidence of ARF was 15.4% (CI 6-31), and there were no cardiovascular events or deaths.
- **Confirmed SC drug overdose was associated with ARF compared to confirmed non-SC overdoses (29.4% vs. 4.5%, p=0.033).**
- **Treatment**: Naloxone infusion was utilized for 5F-MDMB-PICA overdose in two patients with confirmed absence of opioids.

Discussion

- This is the first controlled clinical cohort demonstrating that confirmed SC drug overdose may lead to ARF.
- SC effects on peripheral chemoreceptors and baroreceptors, can increase bronchial airway resistance and pulmonary vascular resistance. Thus, CB1 receptor stimulation could be one of the possible mechanisms of SC-induced respiratory depression (3).
- Naloxone infusion as a treatment for 5F-MDMB-PICA overdose has not previously been reported in the literature.
- Treatment of 5F-MDMB-PICA with naloxone infusions requires further study to assess efficacy.
- Limitations include convenience sampling of waste specimens and relatively small sample size.

Conclusions

- In this observational cohort of adult ED patients with suspected SC exposure, the presence of confirmed SC drugs was associated with acute respiratory failure when compared to non-SC exposed controls.

Bibliography


Acknowledgements

Supported in part by grant DA037317 from the NIH (PI: Manini).
Background

Popularity of novel psychoactive substances (NPS) is increasing and raises the concern for being able to detect these substances when in use. Despite their limitations, typical toxicologic screenings are effective at identifying common substances in circulation such as opiates, amphetamines, cocaine, benzodiazepines, and barbiturates, but novel substances are typically undetected. At present, it is not known what additional substances are being used, whether intentionally or as an additive in other substances. This study aims to identify additional substances in use today.

Objective

The goal of our study was to identify NPS in order to understand which substances are currently being used in study location.

Methods

Observational study at a single academic emergency department. A convenience sample of patients were enrolled by medical providers when intoxication with NPS was suspected by history or negative/discordant drug screen results. Residual blood and urine specimens were used. This study was determined to be exempt by the local institutional review board. Samples were analyzed by high resolution mass spectrometry using a continually updated library of novel opioids, synthetic cannabinoids, and other NPS. Deidentified results are communicated to public health officials and medical staff.

Results

Seventeen patients have been enrolled in the study. From those patients, we identified 79 substances either by parent compound or metabolite (46 parent substances, 30 metabolites, and 3 that can be taken as parent substances but are likely metabolites). Eleven parent compounds are considered NPS, and all but three patients tested positive for at least one of these. The most frequently identified substance was 5F-MDMB-PICA, a synthetic cannabinoid. While not considered NPS, additional substances such as psilocin and MDMA were detected that would not be detected with routine toxicology screening.

Conclusions

NPS are increasingly available and can be expected to be in more frequent usage. Standard toxicologic screening is insufficient to detect the continuously evolving array of NPS and therefore it is often unknown to clinicians what agents a patient has used, expected clinical effects, and optimal management. In this study there were many NPS identified that would not typically be found on standard screening, with synthetic cannabinoids being most frequently identified. All but three of the patients included in the study were positive for NPS. Ongoing surveillance for NPS is needed to inform efforts for law enforcement, public health, and medical professionals.

<table>
<thead>
<tr>
<th>Substance</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>5F-MDMB-PICA</td>
<td>7</td>
</tr>
<tr>
<td>*Synthetic cannabinoid +/− metabolites</td>
<td>9</td>
</tr>
<tr>
<td>2F-Deschloroketamine</td>
<td>1</td>
</tr>
<tr>
<td>Alpha-HP/PIHP</td>
<td>1</td>
</tr>
<tr>
<td>Clonazepam</td>
<td>1</td>
</tr>
<tr>
<td>Fentanyl</td>
<td>1</td>
</tr>
<tr>
<td>Flualprazolam</td>
<td>1</td>
</tr>
<tr>
<td>HO-PCP</td>
<td>1</td>
</tr>
<tr>
<td>MDMA</td>
<td>1</td>
</tr>
<tr>
<td>MeO-PCP</td>
<td>1</td>
</tr>
<tr>
<td>Mitragynine</td>
<td>1</td>
</tr>
<tr>
<td>N-ethyl Deschloroketamine</td>
<td>1</td>
</tr>
<tr>
<td>Psilocin</td>
<td>1</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>7</td>
</tr>
<tr>
<td>Benzodiazepines</td>
<td>8</td>
</tr>
<tr>
<td>Opiates</td>
<td>5</td>
</tr>
</tbody>
</table>
Characteristics of Adolescent Cannabis-Associated Emergency Department Visits

Jennifer S. Love MD<sup>a,b</sup>, Robert G. Hendrickson MD, FACMT<sup>a,b</sup>

<sup>a</sup> Oregon Health & Science University, <sup>b</sup> Oregon Poison Center

**Background:**

As cannabis has been legalized, toddler exposures, adult intoxication and adult gastrointestinal disease associated with cannabis have been increasingly described. Few studies have examined the scope and clinical characteristics of cannabis-related emergency department (ED) visits among adolescent patients.

**Objective**

Describe the characteristics of cannabis-related ED visits in adolescent patients.

**Methods**

- Prospective study of ED visits related to cannabis use at single academic pediatric ED from 9/2018 – 7/2019.
- ED providers were asked “Do you think cannabis use was a significant factor leading to today’s ED visit?” and Yes/No recorded in chart.
- Descriptive statistics in Microsoft Excel.

**Results**

64 cannabis associated visits (1.8% total ED visits)

<table>
<thead>
<tr>
<th>DEMOGRAPHICS</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean age (years)</td>
<td>16.8</td>
</tr>
<tr>
<td>% male</td>
<td>48</td>
</tr>
<tr>
<td>% female</td>
<td>52</td>
</tr>
<tr>
<td>% exposure history known</td>
<td>80</td>
</tr>
<tr>
<td>% exposure history unknown</td>
<td>13</td>
</tr>
<tr>
<td>% arrived by private vehicle</td>
<td>45</td>
</tr>
<tr>
<td>% arrived by ambulance</td>
<td>52</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>MEANS OF CANNABIS USE</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>% smoking</td>
<td>81</td>
</tr>
<tr>
<td>% dabbing</td>
<td>1.6</td>
</tr>
<tr>
<td>% ingesting</td>
<td>1.6</td>
</tr>
<tr>
<td>% unknown means of use</td>
<td>16</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>ED VISIT TESTING</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>Mean lab tests ordered</td>
<td>4</td>
</tr>
<tr>
<td>% urine drug screen ordered</td>
<td>31</td>
</tr>
<tr>
<td>% received social work consult</td>
<td>8</td>
</tr>
<tr>
<td>Mean hospital charge ($)</td>
<td>2493</td>
</tr>
</tbody>
</table>

**Results cont’d**

91% of patients discharged from the ED

<table>
<thead>
<tr>
<th>ED DISPOSITION DIAGNOSES</th>
<th></th>
</tr>
</thead>
<tbody>
<tr>
<td>% gastrointestinal (GI) related</td>
<td>23</td>
</tr>
<tr>
<td>% trauma related</td>
<td>19</td>
</tr>
<tr>
<td>% mental health related</td>
<td>17</td>
</tr>
<tr>
<td>% intoxication related</td>
<td>12</td>
</tr>
<tr>
<td>% CNS related</td>
<td>11</td>
</tr>
<tr>
<td>% Other</td>
<td>17</td>
</tr>
</tbody>
</table>

**Conclusions**

- Most adolescents with cannabis-related ED visits have a known exposure.
- Most diagnoses are GI, trauma or mental health related conditions secondary to cannabis use.
- Most adolescent patients are discharged from the ED.
Novel Use of Fomepizole (4-MP) for CYP2E1 Inhibition in Acetaminophen (APAP) Overdose
Stephanie Link DO1, Paul Eckerle MD1, Garrett Rampon2, Haley Wartman1, Stephen Osmon MD1, Anthony Scalzo MD1, Barry Rumack MD3
1. Saint Louis University School of Medicine, 2. University of Kansas Medical Center, 3. University of Colorado School of Medicine

Background
- Acetaminophen (APAP) overdose is leading cause of acute liver failure worldwide.
- Acetaminophen (APAP) and Alcohol dehydrogenase (ADH) are both important in the metabolism of ethanol. The metabolism of ethanol is important in the metabolism of acetaminophen.

APAP Overdose Mechanism of Action
- Glutathione (GSH) is the primary protective mechanism against APAP toxicity. GSH conjugates APAP to form N-acetyl-L-cysteine (NAC) which is excreted in urine.
- If GSH is depleted, APAP is converted to N-acetyl-p-benzoquinone imine (NAPQI), which can bind to DNA and cause cell death.
- Fomepizole (4-MP) is a potent alcohol dehydrogenase and cytochrome P450 inhibitor with biologic plausibility to treat APAP overdose.

Stages of Overdose
- Stage 1: 0-24 hrs
  - Nausea, vomiting, diaphoresis
  - AST/ALT rises
  - Liver damage

- Stage 2: 24-72 hrs
  - Jaundice, ascites, renal dysfunction, LFTs, PT increase
  - Hepatic failure

- Stage 3: 72-96 hrs
  - Extrahepatic organ failure
  - Liver death

Case Series: Utilizing Fomepizole in APAP Overdose

CASE #1
- 49 year old woman with history of depression presented for acute encephalopathy following ingestion (4 hours ago) of laxatives and unknown ingested

CASE #2
- 14 year old girl presented with acute encephalopathy and lethargy following ingestion of unknown quantities of APAP and diphtheriasine

CASE #3
- 9 year old boy presented with ingestion of large quantity of acetaminophen

CASE #4
- 15 year old girl with history of depression with prior suicide attempts presented with severe nausea and emesis after ingesting intentional polysubstance ingestion with estimated 100 tablets of 500 mg APAP. First presented to referral hospital.

Discussion
- Fomepizole (4-MP) is a potent inhibitor of CYP2E1, almost completely prevents formation of hepatotoxic metabolites of APAP.
- Fomepizole given orally is effective in poisoning due to APAP and fumagillin.

References
Novel Use of Fomepizole (4-MP) for CYP2E1 Inhibition in Acetaminophen (APAP) Overdose

Stephanie Link DO, Paul Eckerle MD, Garrett Ramponi2, Haley Wartman1, Stephen Osman MD, Anthony Scalzo MD, Barry Rumack MD

1. Saint Louis University School of Medicine, 2. University of Kansas Medical Center, 3. University of Colorado School of Medicine

Background
- Acetaminophen overdose is leading cause of acute liver failure world-wide
- Maximum therapeutic dose: Adult < 4 g per day, Child 50-75 mg/kg/day
- Standard therapy is with IV N-acetylcysteine (NAC) but there are still reports of hepatotoxicity with treatment
- Fomepizole (4-MP) is a potent alcohol dehydrogenase and cytochrome P450 inhibitor with biologic plausibility to treat APAP overdose
- Case series of 7 patients with standard therapy and fomepizole (4-MP) who had no significant liver injury despite persistently elevated APAP levels

APAP Overdose Mechanism of Action
- Fomepizole (4-MP) inhibits CYP2E1, the major enzyme responsible for APAP metabolism
- In animal studies, fomepizole shown to reduce conversion of APAP to NAPQI
- Well studied for inhibition of alcohol dehydrogenase in toxic alcohol and glycol ingestion
- In clinical studies, fomepizole shown to reduce conversion of APAP to NAPQI

Case Series: Utilizing Fomepizole in APAP Overdose

CASE #1
49 year old woman with history of depression presented for acute encephalopathy following ingestion (4 hours ago) of benzodiazepines and unknown co-ingestants

CASE #2
14 year old girl presented with acute encephalopathy and lethargy following ingestion of unknown quantities of APAP and diphenhydramine

CASE #3
9 year old boy presented with ingestion of large quantity of acetaminophen

CASE #4
15 year old girl with history of depression with prior suicide attempts presented with severe nausea and vomiting after ingesting an estimated 100 tablets of 500 mg APAP. First presented to referral hospital.

Discussion
- Increases glutathione stores
- Acts as glutathione substitute and binds NAPQI
- Enhances sulfate conjugation
- Can still have hepatotoxicity

References
A 49-year-old woman with a history of depression presented for acute encephalopathy following ingestion of 200 tablets of 500 mg APAP, 200 tablets of 200 mg ibuprofen, and 200 tablets of 2 mg of loperamide.

The patient was a 42-year-old woman who presented with nausea, lethargy, and tachycardia following reported ingestion of unknown quantities of APAP and diphenhydramine.

Fomepizole (4-MP) is a potent alcohol dehydrogenase and cytochrome P450 inhibitor with biologic plausibility to treat APAP overdose.

Case series of 7 patients with standard therapy and fomepizole (4-MP) who had no significant liver injury despite persistently elevated APAP levels.

**References**


Background

- Acetaminophen overdose is a leading cause of acute liver failure (ALF) worldwide.
- Acetaminophen (APAP) X-Aminotransferase (AT) also known as AT-P multiplication product is proposed for early risk stratification.
- Standard therapy is with IV N-acetylcysteine (NAC) but there are still reports of hepatotoxicity with treatment.
- Fomepizole (4-MP) is a potent alcohol dehydrogenase and cytochrome P450 inhibitor with biologic plausibility to treat APAP overdose.
- Case series of 9 patients; 7 of which were treated with standard therapy and fomepizole (4-MP) who had no significant liver injury despite persistently elevated APAP levels. The 8th case presented with acute liver injury and fulminant ALF was prevented with the use of fomepizole in addition to standard NAC therapy.

APAP Overdose Mechanism of Action

- Glutathione (GSH) in the liver is converted by the enzyme glutathione S-transferase (GST) to form the inactive metabolite GSSG, which is then oxidized back to GSH by glutathione reductase (GR).
- Acetaminophen (APAP) is oxidized by cytochrome P450 enzymes to form N-acetyl-p-benzoquinoneimine (NAPQI), which is detoxicated by conjugation with glutathione to form N-acetylcysteine (NAC).
- If the amount of APAP ingested is greater than the capacity of the liver to detoxicate NAPQI, NAPQI will react with other cellular constituents, leading to liver necrosis.

Stage 1: Hepatocyte necrosis
Stage 2: Portal tract inflammation
Stage 3: Terminal Kinase

Stages of Overdose

CASE #1
- 49 year old woman with history of depression presented for acute encephalopathy following ingestion of 200 tablets of 500 mg APAP, 200 tablets of 200 mg ibuprofen, and 200 tablets of 2 mg of loperamide.

CASE #2
- 42 year old woman presented with nausea, lethargy, and tachycardia following reported ingestion of acetaminophen (APAP).

CASE #3
- 9 year old boy presented with ingestion of large quantity of acetaminophen.

CASE #4
- 15 year old girl presented after undetermined amount of APAP; later stated someone poisoned her.

CASE #5
- 14 year old girl presented with acute encephalopathy and lethargy following ingestion of unknown amount of APAP.

CASE #6
- 15 year old girl presented following reported intentional ingestion of estimated 100 to 125 tablets of 500 mg APAP in a suicide attempt. Initially presented at community hospital.

CASE #7
- 45 year old male presented after undetermined amount of APAP; later stated someone poisoned him.

Discussion

- Fomepizole (4-MP) - Polytetrafluoroethylene (PTFE) - Well studied for inhibition of alcohol dehydrogenase in toxic alcohol and gluteal ingestion.
- In animal studies fomepizole shown to reduce conversion of APAP to NAPQI.

Case Series: Utilizing Fomepizole in APAP Overdose

- CASE #1
  - Adult patient with history of depression presented for acute encephalopathy following ingestion of 200 tablets of 500 mg APAP, 200 tablets of 200 mg ibuprofen, and 200 tablets of 2 mg of loperamide.
  - Fomepizole given 24 hours after ingestion.

- CASE #2
  - 42 year old woman presented with nausea, lethargy, and tachycardia following reported ingestion of 500 mg APAP.
  - Fomepizole given 4 hours after ingestion.

- CASE #3
  - 9 year old boy presented with ingestion of large quantity of acetaminophen.
  - Fomepizole given 2 hours after ingestion.

- CASE #4
  - 15 year old girl presented after undetermined amount of APAP; later stated someone poisoned her.
  - Fomepizole given 4 hours after ingestion.

- CASE #5
  - 14 year old girl presented with acute encephalopathy and lethargy following ingestion of unknown amount of APAP.
  - Fomepizole given 4 hours after ingestion.

- CASE #6
  - 15 year old girl presented following reported intentional ingestion of estimated 100 to 125 tablets of 500 mg APAP in a suicide attempt. Initially presented at community hospital.
  - Fomepizole given 4 hours after ingestion.

- CASE #7
  - 45 year old male presented after undetermined amount of APAP; later stated someone poisoned him.
  - Fomepizole given 4 hours after ingestion.

- CASE #8
  - Adult patient with history of depression presented for acute encephalopathy following ingestion of 200 tablets of 500 mg APAP, 200 tablets of 200 mg ibuprofen, and 200 tablets of 2 mg of loperamide.
  - Fomepizole given 24 hours after ingestion.

Discussion

- Fomepizole (4-MP) - Polytetrafluoroethylene (PTFE) - Well studied for inhibition of alcohol dehydrogenase in toxic alcohol and gluteal ingestion.
- In animal studies fomepizole shown to reduce conversion of APAP to NAPQI.

Fomepizole (4-MP)

- Decrease glutathione stores
- Acts as glutathione substitute and binds NAC
- Enhance sulfate conjugation
- Can still have hepatotoxicity


References


Higher purpose. Greater good.
Novel Use of Fomepizole (4-MP) for CYP2E1 Inhibition in Acetaminophen (APAP) Overdose

Stephanie Link DO, Paul Eckerle MD, Garrett Rampon, Haley Wartman, Stephen Osmon MD, Anthony Scalzo MD, Barry Rumack MD

1. Saint Louis University School of Medicine, 2. University of Kansas Medical Center, 3. University of Colorado School of Medicine

Background

- Acetaminophen overdose is a leading cause of acute liver failure world-wide
- Maximum therapeutic dose: Adult < 4 g per day, Child 50-75 mg/kg/day
- Standard therapy is with IV N-acetylcysteine (NAC) but there are still reports of hepatotoxicity with treatment
- Fomepizole (4-MP) is a potent alcohol dehydrogenase and cytochrome P450 inhibitor with biologic plausibility to treat APAP overdose
- Case series of 7 patients with standard therapy and fomepizole (4-MP) who had no significant liver injury despite persistently elevated APAP levels

APAP Overdose Mechanism of Action

1. Glucuronidation
2. Uptake into the liver
3. Reduction to NAPQI
4. Excretion of glucuronide conjugate

NAPQI binds to hepatocytes causing cellular necrosis. 

Stage 1: Early liver injury
Stage 2: Hepatic necrosis
Stage 3: Hepatic recovery
Stage 4: Recovery

Case Series: Utilizing Fomepizole in APAP Overdose

CASE #1
49 year old woman with history of depression presented for acute encephalopathy following ingestion (4 hours ago) of two aspirin tablets and unknown non-ingesta.

CASE #2
14 year old girl presented with acute encephalopathy and lethargy following ingestion of unknown quantities of APAP and diphenhydramine.

CASE #3
9 year old boy presented with ingestion of large quantity of acetaminophen.

Stage 5: 0-24 hrs
Stage 2: 24-72 hrs
Stage 3: 72-96 hrs
Stage 4: 4 days - 2 wks

Stage of Overdose

Case 1-7 on Rumack-Matthew Nomogram

Discussion

- Fomepizole (4-MP)
  - Potent inhibitor of CYP2E1
  - Well studied for inhibition of alcohol dehydrogenase in toxic alcohol and glycol ingestion
  - In animal studies fomepizole shown to reduce conversion of APAP to NAPQI

References


Higher purpose. Greater good.
An assessment of the severity of copperhead bites based on extremity
Erin Ryan, Pharm.D.1; James Leonard, Pharm.D., DABAT1
1Maryland Poison Center, University of Maryland School of Pharmacy, Baltimore, MD

Background/objectives
• About 70 copperhead envenomations are reported to the MPC annually
• This study aimed to examine if there was a difference in the severity of envenomations as described by dose of antivenom along with distance and duration of swelling for upper versus lower extremity envenomations

Methods
• Retrospective study of cases reported to single poison center from 2005 – 2019
• Inclusion:
  • Copperhead envenomation
• Exclusion:
  • No envenomation (e.g., no swelling)
• Data Extracted: patient demographics, bite location, onset and duration of swelling, extent of progression of swelling, dose of antivenom received
• Limbs divided into 7 anatomical sections
  • Upper extremity (UE): finger, hand, wrist, forearm, elbow, bicep, and shoulder
  • Lower extremity (LE): toe, foot, ankle, calf, knee, thigh, and hip
• Onset of swelling recorded per case notes, if unclear time of bite and patient arrived with swelling, onset recorded as 1 hour
• Non-parametric tests performed
• Binary variables presented as n (%), continuous as median and interquartile range (IQR)

Results
• 467 cases reviewed, 401 included
• Most bites in late afternoon with different peak between upper and lower
• Similar time to initial swelling 1 hour for UE or LE
• Non-significant difference in duration of swelling: 2 hr (IQR: 1, 5.6) LE vs 4.3 hr (IQR: 1, 7) UE (p=0.147)

<table>
<thead>
<tr>
<th></th>
<th>All* (n=401)</th>
<th>Upper extremity (n=210)</th>
<th>Lower extremity (n=188)</th>
<th>p-value</th>
</tr>
</thead>
<tbody>
<tr>
<td>Male, n (%)</td>
<td>239 (59.6)</td>
<td>130 (68.8)</td>
<td>108 (48.8)</td>
<td>&lt; 0.001</td>
</tr>
<tr>
<td>Female, n (%)</td>
<td>162 (40.4)</td>
<td>59 (31.2)</td>
<td>103 (51.2)</td>
<td></td>
</tr>
<tr>
<td>Age, median (IQR)</td>
<td>44 (23, 56)</td>
<td>47 (32, 59)</td>
<td>39 (20, 52)</td>
<td>&lt; 0.001</td>
</tr>
</tbody>
</table>

*1 unknown location

Figure 1: Hour of day for upper and lower extremity envenomations

Figure 2: Progression of swelling by extremity. Only discrete values included, no values were <0. More progression of swelling in UE [2 sections (IQR: 1, 3)] vs LE [1 section (IQR: 0, 2)]; p<0.001

Figure 3: Total dose of antivenom according to extremity: 8 vials (IQR: 4, 10) LE vs 10 vials (IQR: 6, 12) UE (p=0.004)

Conclusion
Copperhead envenomations have similar onset and duration of swelling irrespective of extremity, but upper extremity swelling progressed across more anatomical sites and generally receive higher doses of antivenom.
A retrospective study of dialysis in poisoning: what, when, and for how long

James Leonard, Pharm.D., DABAT; Faisal Syed Minhaj, Pharm.D.; Amber Ferrell, Pharm.D., CSPI; Joshua King, MD

1Maryland Poison Center, University of Maryland School of Pharmacy, Baltimore, MD
2University of Maryland School of Medicine, Baltimore, MD

Background

- Renal replacement therapy (RRT), such as hemodialysis, is frequently performed to treat acute and chronic poisoning, along with sequelae of poisoning.
- There are limited data describing the number of days patients require RRT after poisoning, the indications for RRT, and the modality of RRT.

Objectives

- Describe the duration, indications, and types of RRT reported to a poison center.

Methods

- Retrospective study of cases reported to single poison center from 2010 – 2019.
- Inclusion:
  - RRT performed.
  - Known start date of RRT.
- Exclusion:
  - No ingestion.
  - Previous RRT before poisoning.
  - Inadequate documentation to determine duration of RRT.
- Dual blinded data extraction from case notes.
- Time of day divided into quartiles (0001-0600; 0601-1200; 1201-1800; 1801-0000).
- Non-parametric tests performed; values presented as median and interquartile range (IQR).

Results

- 525 cases identified and 125 excluded.
- 54.0% male (217/400); median age 47 years (IQR: 33, 58).

Time of day RRT initiated

<table>
<thead>
<tr>
<th>Quartile of day</th>
<th>Number of patients initiated, N (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>0001-0600</td>
<td>77 (19.3)</td>
</tr>
<tr>
<td>0601-1200</td>
<td>39 (9.8)</td>
</tr>
<tr>
<td>1201-1800</td>
<td>158 (39.5)</td>
</tr>
<tr>
<td>1801-0000</td>
<td>84 (21.0)</td>
</tr>
<tr>
<td>Unknown</td>
<td>42 (10.5)</td>
</tr>
</tbody>
</table>

Methods of RRT separated by toxin removal or no toxin removal

<table>
<thead>
<tr>
<th>Method of RRT</th>
<th>Initiated for toxin removal</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Yes</td>
</tr>
<tr>
<td>HD</td>
<td>176 (86.2)</td>
</tr>
<tr>
<td>CRRT</td>
<td>9 (4.4)</td>
</tr>
<tr>
<td>Both</td>
<td>19 (9.3)</td>
</tr>
</tbody>
</table>

Conclusion

In most cases, RRT was performed for drug removal. Patients treated for drug removal generally had fewer days on RRT than those treated for other indications. Median time from presentation to initiation was 9 hours in those treated for toxin removal.

Figure 3 (above): Time to initiation of RRT for four most commonly removed toxins. Median time to RRT initiation of 12 hours (IQR: 7.24) and is shown in Figure 3 for four most common agents. Shorter for cases involving toxin-removal at 9 hours vs 20 hours. Median time: ethylene glycol 8 hours; salicylate 8.6 hours; lithium 10.2 hours; methanol 13.7 hours.
Effect of Implementation of the QT Nomogram at a Regional Poison Center on the Frequency of Magnesium Replacement Recommendations Compared to a Control of QTc >500 msec

Samantha C. Lee, PharmD | Stacey Bangh, PharmD | Travis D. Olives, MD, MPH, MEd
Ann Arens, MD | Jon B. Cole, MD
Minnesota Poison Control System ▪ Minneapolis, Minnesota

Background
- Empiric 2g IV magnesium (mag) was recommended at our poison center (PC) for QTc>500msec to prevent Torsades des Pointes (TdP).
- The QT Nomogram (QTN) has been shown to be more sensitive and specific for predicting drug-induced TdP.
- A poison center quality assurance project was implemented to assess the use of the QTN and its effect on Mag replacement recommendations for TdP prevention.

Methods
- Cases were identified prospectively in our documentation system if the QTN was used to interpret the risk of TdP and the need for mag replacement.
- Mag replacement was recommended only if the QT-HR plotted above the “at-risk” line on the QTN and the serum Mag was <2mg/dL.
- ECG intervals (QT, QTc), heart rates, serum Mag, Mag recommendation and administration, and any acute dysrhythmias were recorded.
- Patients age <13 years-old were excluded.

Results
- The QTN was used in 527 cases during the 3 months following protocol implementation. All available QT-HRs from the initial ECGs were plotted on the QTN (see Graph).
- 94 cases (17.8%) had QTc >500 msec; of these 59 (62.7%) were above the QTN “at-risk” line.
- 409 cases (77.6%) had QTc <500 msec; of these 33 (8%) were above the QTN “at-risk” line.
- Mag was recommended for 47 cases above the QTN “at-risk” line vs. previously would have recommended Mag for all 94 cases with QTc >500 msec (See Table).
- No TdP recorded; one death from APAP related hepatic failure; two cases with self limited runs of VT (both with QTc <500 msec and plotted below the QTN “at-risk” line).

<table>
<thead>
<tr>
<th>QTN at-risk line</th>
<th>Mag Recommended</th>
<th>Mag Recommended, Administered</th>
<th>Mag Not Recommended</th>
<th>Mag Not Recommended, Administered</th>
</tr>
</thead>
<tbody>
<tr>
<td>For QTc &gt;500 msec (n=94)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above (n=59)</td>
<td>31</td>
<td>27</td>
<td>28</td>
<td>5</td>
</tr>
<tr>
<td>Below (n=31)</td>
<td>1</td>
<td>1</td>
<td>30</td>
<td>3</td>
</tr>
<tr>
<td>Unable to plot (n=4)</td>
<td>0</td>
<td>0</td>
<td>4</td>
<td>1</td>
</tr>
<tr>
<td>For QTc &lt;500 msec (n=409)</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Above (n=33)</td>
<td>16</td>
<td>11</td>
<td>17</td>
<td>1</td>
</tr>
<tr>
<td>Below (n=366)</td>
<td>6</td>
<td>6</td>
<td>360</td>
<td>9</td>
</tr>
<tr>
<td>Unable to plot (n=10)</td>
<td>1</td>
<td>1</td>
<td>9</td>
<td>2</td>
</tr>
</tbody>
</table>

Table: Magnesium recommendation and administration per QTN “at-risk” line and QTc intervals

Conclusions
- Implementation of the QTN at our Poison Center led to a 50% decrease in recommendations for prophylactic IV magnesium replacement.
- Further study is needed to determine if the QTN can be used as a standard tool for Poison Centers to determine which patients should receive magnesium.
Pediatric vortioxetine exposures reported to the National Poison Data System from 2013 - 2019

Kristen C. Lee, PharmD, BCPS*, Dawn Sollee, PharmD, DABAT, FAACT*, Jay Schauben, PharmD, DABAT, FAACT*, Carmen Smatherman, MS, MPH*

*Florida/USVI Poison Information Center – Jacksonville, †Center for Data Solutions, University of Florida College of Medicine – Jacksonville

Background

- Antidepressants are among the most commonly-used drug classes in the United States
- Vortioxetine is a novel multimodal antidepressant approved in the United States in 2013 for the treatment of major depressive disorder in adults
- Vortioxetine is an agonist at the 5HT7, SHT1B and SHT1D receptors, a partial agonist at the SHT1B receptor, an agonist at the SHT1A receptor, and an inhibitor of the SHT transporter
- Recent studies demonstrate its safety and efficacy in children and adolescents at doses similar to those used in adults
- Limited information exists regarding toxicity from vortioxetine exposures
- To date, the epidemiology and toxicity of pediatric vortioxetine exposures has not been analyzed

Objectives

- Characterize the frequency, clinical manifestations, treatments, duration of effects, and medical outcomes of pediatric vortioxetine exposures reported to the National Poison Data System (NPDS) from 2013 to 2019
- Determine an appropriate dose-exposure threshold for home monitoring of pediatric vortioxetine exposures

Study Design

- Non-interventional, IRB approved, retrospective cohort of NPDS data
- Queried from 01/01/2013 – 12/31/2019

Exclusion

- Unknown age ranges or age 2 years or younger
- Non-human exposures
- Confirmed non-exposures
- Multiple-product exposures

Statistical analysis:

- Categorical variables summarized using counts and percentages
- Continuous variables summarized using means and standard deviation (normally distributed) or medians and interquartile ranges (not normally distributed)
- Poisson regression models for prediction of yearly exposure increase
- Significance set at 5%

Patient Selection & Demographics

- All patients
- Excluded non-exposure (n = 9)
- Excluded age <5 (n = 5)
- Excluded non-exposure (n = 138)
- Excluded not followed or unable to follow (n = 226)
- Excluded unrelated effect (n = 11)

Results: Reported Clinical Effects

- All patients
- Moderate outcome patients (n = 8)

Results: Management Site and Disposition

- Management site
- On-site
- En route to hospital
- Referred to hospital

- Disposition
- No effect (n = 256)
- Minor/moderate effect (n = 62)
- p-value

Results: Effect Based on Amount Ingested

- Amount ingested
- No effect (n = 58)
- Moderate/minor effect (n = 19)

Results: Predicted Incidence of Exposure

- Incidence rate of exposure increased 18% every year (p < 0.001)

Limitations

- Retrospective chart review
- Poison center data
- Voluntary reporting
- Inaccuracy of coding
- Decision to follow/not follow
- Provider/parent-dependent management decisions

Conclusions

- Accidental pediatric exposures to vortioxetine resulted in minimal toxicity
- Most common effects were vomiting and drowsiness/lethargy
- Most cases were managed at home
- Pending further studies, supports home management for accidental exposures in asymptomatic pediatric patients
- Suggests no harm in home management for mildly symptomatic pediatric patients

References

Life Threatening Tachydysrhythmia Due to Chronic Theophylline Toxicity Successfully Managed with Amiodarone

Jacob A Lebin MD\textsuperscript{1,2}, Anita Mudan MD\textsuperscript{1,2}, Neal L Benowitz MD\textsuperscript{2}
1. Department of Emergency Medicine, University of California San Francisco
2. California Poison Control System, San Francisco Division
Life Threatening Tachydysrhythmia Due to Chronic Theophylline Toxicity Successfully Managed with Amiodarone

Jacob A Lebin MD1,2, Anita Mudan MD1,2, Neal L Benowitz MD2
1. Department of Emergency Medicine, University of California San Francisco
2. California Poison Control System, San Francisco Division

BACKGROUND

• Theophylline is now rarely encountered in the management of reactive airway disease due to its narrow therapeutic window and adverse effects

• Along with plant-derived caffeine and theobromine, theophylline is a methylxanthine and primarily acts as an adenosine receptor antagonist, resulting in stimulation of β1 and β2 receptors

• Cardiac dysrhythmias, particularly tachydysrhythmias, are common in acute and chronic theophylline toxicity. However, theophylline toxicity is seldom considered in the differential for life-threatening tachycardia given its limited use

• We describe a case of life-threatening tachydysrhythmia due to theophylline toxicity that was successfully managed with amiodarone.

CASE

• A 78-year-old man with COPD on theophylline (400mg extended release daily) presented to the ED with altered mental status and tachypnea. His heart rate was 169 beats per minute and electrocardiogram showed sinus tachycardia.

• Labs were notable for the following: potassium 2.5 mmol/L, creatinine 1.7 mmol/L (baseline 0.8 mmol/L), troponin 2.4 ng/mL, lactate 4.2 mmol/L.

• He was intubated for hypercarbic respiratory failure. In the ICU, he developed new onset atrial fibrillation associated with hypotension. Theophylline toxicity was not considered as an etiology.

• He was started on amiodarone and norepinephrine infusions, with improvement in his heart rate to 120 beats per minute and normalization of blood pressure.

• The following day, he converted to normal sinus rhythm, his heart rate improved, and the norepinephrine was discontinued. A theophylline level, sent at presentation, resulted two days later at > 40 µg/mL.

DISCUSSION

• Theophylline enhances atrial automaticity and intra-cardiac conduction, increasing the occurrence of atrial fibrillation and other supraventricular tachydysrhythmias.

• Traditional management of theophylline toxicity includes the use of beta-adrenergic receptor antagonists to improve cardiac output.

• Amiodarone, a class III antiarrhythmic with beta-adrenergic receptor antagonist properties, likely provided rate control, prolonging diastole and increasing stroke volume.

CONCLUSION

• Theophylline toxicity is rare and can result in tachycardia-induced cardiovascular collapse. Amiodarone may be useful in managing life-threatening theophylline associated tachydysrhythmias.
Silica Gel Products: Not Always Benign
Lassiter, N., Yang, N., Tiyyagura, L., Whittlow, K.S.,
1. Touro University – California – 2. Sacramento City College – 3. Lakshma Tiyyagura, MD - Gastroenterology

Background:
- Silica Gel can be used as a desiccant to absorb moisture from the environment and keep medications dry.
- Silica Gel has been regarded as a benign substance when orally ingested with no adverse effects noted.
- Historically, Silica Gel has ubiquitously been packaged in paper or cloth packaging (left image), that have only posed a choking hazard in young children.
- However, medical device manufactures have begun to construct new non-malleable desiccant cylindrical cannisters (right image) which increase the risk of obstruction.

Case Report:
- 70-year-old male with a past medical history of chronic dysphagia, Barrett’s esophagus, and lower esophageal sphincterotomy presented to emergency department with chest pain, foreign body sensation in esophagus, and difficulty swallowing after taking his multiple morning medications.
- Workup for chest and epigastric pain were negative, so patient was set to discharge to be managed as an outpatient.
- Prior to discharge a PO challenge was ordered, which resulted in the return of the foreign body sensation in his esophagus.
- CT was ordered which showed a 15mm foreign body within the esophagus and the foreign body located near the GE junction.
- Patient was then endotracheally intubated, placed under deep sedation, and performed a second EGD using a Roth net retriever™
- Obstruction was successfully removed and determined to be a cylindrical silica gel cannister measuring 11.5mm.

Discussion:
- Patient’s History of high-grade esophageal stricture increased the risk of esophageal obstruction by a foreign body.
- The design of the new desiccant canisters may look like many medications, which increases the risk of unintentionally being consumed.
- The non-malleable design makes production more cost and time efficient but also makes the desiccant cannisters more likely to cause an esophageal obstruction and increase morbidity in elderly at-risk populations.

Conclusion:
- Cylindrical desiccant cannisters pose an increased risk of esophageal obstruction in patients with high risk of esophageal obstruction.
- Post-market surveillance should be continued to ensure that these incidents are few and far between.
- We don’t want to utilize a product that risks consumer safety to boost production and cut costs.

References:
8. Lakshma Tiyyagura, MD - Gastroenterology.
A Formula for Disaster? Inadvertent Ivermectin Ingestion in an Infant
Rebecca Lange, PharmD | Nathan Kunzler, MD | Jon Cole, MD
Minnesota Poison Control System □ Minneapolis, Minnesota

Background
- Ivermectin is an anti-helminthic agent used in human and veterinary medicine.
- Ivermectin activates glutamate-gated chloride channels in invertebrates.
- At therapeutic doses ivermectin does not penetrate the CNS due to p-glycoprotein drug pump activity (MDR1).
- MDR1 is saturated in high doses and ivermectin has been reported to cause neurotoxicity.

Case Report
- A 7 month old female weighing 8.64 kg was given a bottle of formula inadvertently mixed with 4-5 ounces of 0.1% ivermectin solution.
- Estimated dose was 13.9-17.4 mg/kg.
- Vitals at presentation: HR 142, BP 109/79, pulse oximetry 100% on room air.

Discussion
- The patient had total of 5 episodes of vomiting while in the emergency department and was treated with a dose of ondansetron.
- She was admitted for overnight observation, no neurological symptoms or hemodynamic instability was noted and she was discharged the following day.

Conclusions
- The toxic dose of ivermectin in humans is unclear.
- We report an unintentional but large overdose in a child with only mild GI symptoms.
- Without further clarity about the circumstances that lead to neurotoxicity, observation in the case of overdoses is prudent.
Background

- Clonidine and guanfacine are alpha-2 agonists used in treating attention-deficit/hyperactivity disorder (ADHD) in children.
- US poison control centers have experienced an increased incidence of calls regarding these medications.
- Severe and life-threatening symptoms (e.g., hypotension, respiratory depression, death) have been noted in single-dose ingestions.
- Therapeutic errors are often above current referral thresholds which are based on studies including patients who were naïve to alpha-2 agonists.

Objective

To characterize acute unintentional pediatric therapeutic errors for clonidine and guanfacine to better understand outcomes of overdose in pediatric patients chronically taking alpha-2 agonists.

Methods

- Retrospective analysis of clonidine and guanfacine therapeutic errors reported to the Utah Poison Control Center (UPCC) and exported from Toxidrome database.
- Date Range: January 1, 2008 through December 31, 2018.

Results

- There were 222 single-substance exposures involving clonidine or guanfacine reported to UPCC:
  - 207 (93.2%) cases were followed to a known outcome.
  - Clonidine cases: 116 (50%) cases.
  - Guanfacine cases: 91 (44%) cases.
- The majority of exposures were male (76.8%).

- Of the 10 documented scenarios, double dose was the most commonly reported (Table 1).
- No major effects or deaths were reported (Table 2).

Results Continued

- More severe symptoms occurring less frequently included respiratory depression (1, 0.5%), slurred speech (1, 0.5%), syncope (1, 0.5%), and tachycardia (1, 0.5%). IV fluids was the most commonly performed therapy in clonidine and guanfacine (3.3%), atropine (2.7%), and naxoside (2.7%). IV fluids were also performed in clonidine exposures. No vasopressors were documented as administered.

Medical outcomes following double doses were not statistically different between age ranges 5-8 years old and 9-18 years old (Figure 1).

Table 3: Clinical Effects >3%

<table>
<thead>
<tr>
<th>Condition</th>
<th>Clonidine (N=116)</th>
<th>Guanfacine (N=91)</th>
<th>Total (N=207)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Drowsiness/Lethargy</td>
<td>57 (49.1%)</td>
<td>25 (27.5%)</td>
<td>82 (39.6%)</td>
</tr>
<tr>
<td>Hypotension</td>
<td>1 (12.1%)</td>
<td>8 (8.8%)</td>
<td>22 (10.4%)</td>
</tr>
<tr>
<td>Bradycardia</td>
<td>10 (8.6%)</td>
<td>10 (11.0%)</td>
<td>20 (9.7%)</td>
</tr>
<tr>
<td>Dizziness/Vertigo</td>
<td>4 (3.4%)</td>
<td>3 (3.3%)</td>
<td>7 (3.4%)</td>
</tr>
</tbody>
</table>

Conclusion

- Effects of alpha-2 agonists in overdose are similar to adverse effects in therapeutic use.
- No major effects or deaths were reported.
- Double doses of alpha-2 agonists are the most common therapeutic error and can result in moderate clinical effects regardless of age group. Patients with a double dose over referral thresholds warrant health care facility referral.
Characterizing Pediatric Clonidine and Guanfacine Unintentional Therapeutic Errors

Joseph Lambson, Kaitlyn Brown
Utah Poison Control Center, College of Pharmacy, University of Utah, Salt Lake City, Utah

Background

- Clonidine and guanfacine are alpha-2 agonists used in treating attention-deficit/hyperactivity disorder (ADHD) in children
- US poison control centers have experienced an increased incidence of calls regarding these medications
- Severe and life-threatening symptoms (e.g., hypotension, respiratory depression, death) have been noted in single-dose ingestions
- Therapeutic errors are often above current referral thresholds which are based on studies including patients who were naïve to alpha-2 agonists

Objective

- To characterize acute unintentional pediatric therapeutic errors for clonidine and guanfacine to better understand outcomes of overdose in pediatric patients chronically taking alpha-2 agonists

Methods

- Retrospective analysis of clonidine and guanfacine therapeutic errors reported to the Utah Poison Control Center (UPCC) and exported from Toxicall database
- Date Range: January 1, 2008 through December 31, 2018

Results

- Of the 10 documented scenarios, double dose was the most commonly reported (Table 1)
- No major effects or deaths were reported (Table 2)

<table>
<thead>
<tr>
<th>Table 1: Scenario</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
</tr>
<tr>
<td>Clonidine (N=114)</td>
</tr>
<tr>
<td>Guanfacine (N=91)</td>
</tr>
<tr>
<td>Total (N=207)</td>
</tr>
<tr>
<td>Double Dose</td>
</tr>
<tr>
<td>Wrong Medication</td>
</tr>
<tr>
<td>Other Incorrect Dose</td>
</tr>
<tr>
<td>Too Close Together</td>
</tr>
<tr>
<td>Other Unknown Ther. Error</td>
</tr>
<tr>
<td>Hypotensive Error</td>
</tr>
<tr>
<td>Incorrect Form/Conc. Given</td>
</tr>
<tr>
<td>10 Fold Dosing Error</td>
</tr>
<tr>
<td>Confused Unit of Measure</td>
</tr>
</tbody>
</table>

- Known doses (in mg) were available for 32 (27.6%) clonidine cases and 23 (25.3%) guanfacine cases. The lowest clonidine dose in the 6-8 year bracket to cause moderate effects was 0.1 mg. The lowest clonidine dose in the 9-18 year bracket to cause moderate effects was 0.4mg. No guanfacine cases with moderate effects had a documented dose
- 113 (54.6%) cases were managed at home and 74 (35.7%) cases were referred to a health care facility by UPCC. 9 (4.3%) cases were admitted to a noncritical care unit and 1 (0.5%) case was admitted to a critical care unit
- There were 18 reported clinical effects. The most common clinical effects >3% were drowsiness/lethargy, hypotension, bradycardia, and dizziness/vertigo (Table 3)

Results Continued

- More severe symptoms occurring less frequently included respiratory depression (1, 0.5%), slurred speech (1, 0.5%), syncope (1, 0.5%), and hallucination (1, 0.5%)
- IV fluids was the most commonly performed therapy in clonidine (13, 11.2%) and guanfacine (3, 3.3%). Atropine (2, 1.7%) and naloxone (2, 1.7%) were also performed in clonidine exposures. No vasoressors were documented as administered
- Medical outcomes following double doses were not statistically different between age ranges 5-8 years old and 9-18 years old (Figure 1)
Comparative Toxicity and Effects of Milnacipran vs. Levomilnacipran
Utilizing Data Reported to the National Poison Data System
Leslie Lai, PharmD, Anita Ma, PharmD, Ben Tsutaoka, PharmD, DABAT.
University of California San Francisco, Department of Clinical Pharmacy, San Francisco, California, USA.

**BACKGROUND**

Milnacipran (Savella®) (MLN) vs Levomilnacipran (Fetzima®) (LMN) are serotonin-norepinephrine reuptake inhibitors (SNRIs) approved by the U.S. Food and Drug Administration (FDA) for the treatment of fibromyalgia in 2009.

> MLN toxicity is characterized by gastrointestinal, neurologic and cardiovascular effects.
> Somnolence, nausea, vomiting, tachycardia, hypertension and seizures.
> LMN is the L-enantiomer of MLN, approved by the FDA for major depressive disorder in 2013.
> Clinical effects are characterized as benign and fatalities have not been reported.
> MLN and LMN, in contrast to other SNRIs, more potently inhibit norepinephrine reuptake relative to serotonin reuptake.
> No retrospective reviews have compared the toxicity between MLN and LMN.

**Purpose:** The objective of this study is to compare both drug’s clinical effects and medical outcomes of exposures reported to the National Poison Data System (NPDS).

**METHODS**

A retrospective cohort study was conducted analyzing NPDS data for single agent (VLF or DUL) exposures reported to the American Association of Poison Control Centers (AAPCC) from August 2013 through December 2018.

- Excluded cases: multiple medication ingestions, non-ingestion route, outcomes that were unrelated, confirmed non-exposures, and no follow-up.
- Case outcomes as defined by AAPCC criteria and symptoms were compared.
- Chi-square or Fischer exact test, relative risk and 95% confidence intervals were calculated between MLN and LMN for case outcomes as defined by AAPCC criteria, combined outcomes deemed mild that included no or minor effects, combined outcomes deemed severe that included moderate or major effects and death, and the most commonly reported symptoms.

**RESULTS**

> Cases meeting inclusion criteria: MLN, n=91 and LMN, n=161.
> Most patients were female: MLN=69.2% and LMN=70.2%.
> Median age: MLN=11 years (13 months to 84 years) and LMN=25 years (11 months to 89 years).
> There were no significant differences in outcome between MLN vs LMN (Table 1).
> The most common symptoms in the MLN group were: vomiting, tachycardia, drowsiness/lethargy. The most common symptoms in the LMN group were: tachycardia, agitation/irritability, dizziness/vertigo (Table 2).
> MLN patients were at a significantly greater risk of developing vomiting (Table 2).

**DISCUSSION**

> MLN and LMN are SNRIs approved for fibromyalgia and major depressive disorder, respectively.
> LMN, 1S-2R-milnacipran, is the more potent of the enantiomers found in racemic milnacipran in comparison to 1R, 2S-milnacipran.
> The median age of the MLN exposures was much lower than that of the LMN exposures.
> Despite these variances, no significant difference in outcome was determined between the two drugs.
> Limitations:
  - Retrospective design and the potential for reporting bias due to voluntary case reporting to poison centers.
  - There is the potential for miscoding of data and incomplete information from coding variability in the NPDS data.
  - There are no reported measurable drug levels in the NPDS data.

**CONCLUSION**

> In this review of national data comparing MLN vs LMN, MLN demonstrated a greater risk of developing vomiting however there were no significant differences between the outcomes of these two drugs.
> There were no documented seizures or deaths in the cases evaluated in this study. Both medications are relatively safe, rarely resulting in serious effects. The results of this study demonstrate that MLN and LMN may be safer alternatives to other SNRIs.

**REFERENCES**

This study describes the pattern of vaccine adverse events reported among older adults.

**METHODS**

Data source: Vaccine Adverse Event Reporting System (VAERS)

Cases were vaccine adverse events where:
- Patient age 65 years or older;
- Vaccination occurred during 1991-2018;
- Total cases: 71,880

Analyses: Distribution of cases by selected variables was determined and descriptive statistics used.

**RESULTS**

Figure 2. Vaccine adverse events among patients age 65 years or older, Vaccine Adverse Event Reporting System, 1991-2018, by patient sex

Figure 3. Vaccine adverse events among patients age 65 years or older, Vaccine Adverse Event Reporting System, 1991-2018, by most common vaccines

Figure 4. Annual number of vaccine adverse events among patients age 65 years or older, Vaccine Adverse Event Reporting System, 1991-2018, by most common symptoms

Figure 5. Annual number of vaccine adverse events among patients age 65 years or older, Vaccine Adverse Event Reporting System, by most common vaccines

Figure 6. Vaccine adverse events among patients age 65 years or older, Vaccine Adverse Event Reporting System, 1991-2018, by season

Figure 7. Vaccine adverse events among patients age 65 years or older, Vaccine Adverse Event Reporting System, 1991-2018, by most common states

Figure 8. Vaccine adverse events among patients age 65 years or older, Vaccine Adverse Event Reporting System, 1991-2018, by most common symptoms

Figure 9. Vaccine adverse events among patients age 65 years or older, Vaccine Adverse Event Reporting System, 1991-2018, by outcome

**CONCLUSIONS**

The number of vaccine adverse events among older adults decreased with increasing age and most often involved women.

The number of cases increased during 1991-2018, and the majority occurred during September-December.

While the majority of cases involved an emergency department or doctor visit, relatively few were considered serious, although 5.4% required in order for VAERS to accept the report.

No proof that the event was caused by the vaccine is described. No proof that the event was caused by the vaccine is required in order for VAERS to accept the report.

Note: References are available upon request. Dr. Kurt is Chair of the AACT Geriatric Toxicology Section.
A CASE REPORT OF AN INADVERTENT ORAL EXPOSURE TO XYLAZINE IN AN INFANT

Kuhn1 BR, Merz2 RB
1BANNER POISON & DRUG INFORMATION CENTER, 2CARDON CHILDREN’S MEDICAL CENTER

BACKGROUND

- Xylazine is a parenteral, non-narcotic analgesic and sedative used in veterinary practice.
- Structurally similar to phenothiazines (1,4-thiazines) and tricyclic antidepressants
- Pharmacologically similar to clonidine and thus a potent partial agonist of central and peripheral pre-synaptic alpha2 receptors
- Results in decreased sympathetic tone
- Clinical effects can include sedation, hypotension, respiratory depression, among other clinical effects
- Previous case reports describe intravenous or ocular exposures in pediatric and/or adult populations. We present what we believe is the first infant oral exposure.

PHARMACOKINETICS

- Typical concentration of 100mg/ml
- Good oral absorption
- Half-life 2-3 hours

CASE - EMERGENCY DEPARTMENT

- A 4.4kg, 10-week old female patient inadvertently ingested an unknown quantity of xylazine which resulted in sedation.
- She was admitted to the pediatric intensive care unit for overnight observation and supportive care.

CASE FOLLOWUP

- Upon further questioning, the mother revealed she had assisted a veterinarian by drawing up 2 syringes filled with xylazine. These syringes were stored in a cup that the patient would later drink from.

DISCUSSION

- An oral exposure to xylazine by an infant resulted in minimal but sustained sedation and bradypnea that resolved with supportive care. This patient’s treatment included physical stimulation and high-flow nasal canula oxygen supplementation until she metabolized the drug and returned to her baseline prior to discharge. Her abnormal EEG relation to the ingestion is unclear. Follow-up after discharge was unable to be performed. We believe this represents the first case report of an oral xylazine exposure in an infant.

LABORATORY ANALYSIS

- Urine immunoassay (collected ~30 minutes after presentation) was negative for all compounds.
- Urine GC/MS (collected ~30 minutes after presentation) demonstrated the presence of xylazine. No other compounds were detected.
- A subsequent urine sample was analyzed by GC/MS ~33 hours after presentation and demonstrated the presence of xylazine and levetiracetam.
- The serum xylazine concentration was reported as 80ng/ml ~33 hours after presentation.

SUMMARY

- A 4.4kg, 10-week old female patient inadvertently ingested an unknown quantity of xylazine which resulted in sedation.
- She recovered without sequelae after an overnight observation period and supportive care in a pediatric intensive care unit.
- It was finally determined that xylazine syringes used to euthanize the family horse had been stored in a cup the patient subsequently drank from.

CASE - PEDIATRIC INTENSIVE CARE UNIT

- On arrival to the PICU, her presentation was notable for persistent sedation (GCS of 13-14), bradypnea (range 20-32), a right, upward eye deviation, bradycardia (range 88-98 beats per minute), and mild hypotension (range systolic 69-89mmHg).
- A continuous electroencephalogram was ordered. Findings consistent with a focal seizure disorder. She was started on IV levetiracetam 110mg twice daily.
- By the following afternoon (~20 hours after initial presentation) her bradycardia and bradypnea had fully resolved. HFNC oxygen was discontinued. She was empirically started on IV ceftriaxone 273mg twice daily for suspected meningitis.
- A serum xylazine level was ordered.
- Upon further questioning, the mother revealed she had assisted a veterinarian by drawing up 2 syringes filled with xylazine. These syringes were stored in a cup that the patient would later drink from.
BACKGROUND

Arizona has two regional poison centers. The Banner Poison and Drug Information Center (BPDIC) located in Phoenix covers Maricopa County while the State’s remaining 14 counties are covered by the Arizona Poison and Drug Information Center (APDIC) located in Tucson. Envenomations by Centruroides sculpturatus (Arizona bark scorpion) represent the single largest exposure category for both poison centers. Since 2011, BPDIC and APDIC have received fewer reported scorpion envenomations of approximately 7.9% annually. Interestingly, the state’s population has shown a consistent increase during this timeframe, adding an average of 96,000 residents each year.

On January 26, 2020, the Arizona Department of Health Services (AZDHS) reported an index patient diagnosed with the novel coronavirus (SARS-CoV-2) or COVID-19. Among the various restrictions imposed to limit the spread of the virus among the state’s population were school and non-essential business closures, cancellation of elective surgical procedures, and a “Stay Home, Stay Healthy, Stay Connected” order. The net effect from these executive orders was an increase of time spent by family members in their homes. Through a review of the National Poison Data System (NPDS) a noticeable increase in scorpion envenomations was observed during this timeframe compared to the previous year.

TIMELINE

- March 11 - Declaration of Emergency announced by Governor
- March 31 - “Stay Home, Stay Healthy, Stay Connected” order issued
- May 15 - “Stay Home, Stay Healthy, Stay Connected” order expires
- July 23 - School opening delayed from August 6 to the 17th

RESULTS

Table 1 shows the annual reporting of scorpion envenomations to our poison centers and Arizona’s population change in Arizona from 2010 to 2019. Once the implementation of the shelter in place order began on May 31 BPDIC and APDIC observed a sustained increase in reported scorpion envenomations. This increase continued after the shelter in place order expired as well. Despite a projected 7.9% decrease in call volume for 2020 BPDIC and APDIC observed a 21.4% increase in reported scorpion envenomations since March 15, 2020 compared to this same timeframe in 2019.

DISCUSSION

During a “Stay Home, Stay Healthy, Stay Connected” executive order a 21.4% increase in reporting of scorpion envenomations was observed. The net effect of this order, coupled with an increased fear of accessing urgent care or emergency departments and relative inability to access primary care providers resulted in a shift towards increased telemedicine utilization. Poison Centers are uniquely positioned and have a responsibility to provide education and awareness to the community regarding safety practices in the home which can reduce the risk of unintentional envenomations and other poisonings. A direct communication was provided to area emergency department staff to advise of the increased envenomation reporting and to suggest an adjustment of their antivenom inventory as necessary.
INTEGRATION OF GRADUATE MEDICAL STUDENTS FOR A POISON CENTER’S COVID-19 RESPONSE IN ARIZONA

Kuhn BR¹,3, Roland M¹,3, Brooks DE ¹,2,3

¹Banner Poison & Drug Information Center ²Banner University Medical Center – Phoenix ³Center for Toxicology & Pharmacology Education and Research

METHODOLOGY

Since January of 2020, the novel coronavirus SARS-CoV-2 (COVID-19), has become an increasing public health threat that has strained the United States healthcare system. The Banner Poison and Drug Information Center (BPDIC) worked closely with the Arizona Department of Health Services (ADHS) and Maricopa County Department of Public Health (MCDPH) in previous public health threats. These existing relationships for a rapid development of a COVID-19 Hotline for the state of Arizona (managed by the two poison centers in Arizona) and separate line for MCDPH (managed by BPDIC). Based on the predicted surge in call volume, a COVID-19 rotation for graduate medical education students (GMES) was developed. The GMES students were oriented on COVID-19 pathophysiology, testing, treatments, public health epidemiology and documentation in the electric health record system used by BPDIC. The rotation fulfilled clinical requirements for GMES removed from other rotations due to COVID-19 restrictions.

RESULTS

The first rotation started on March 24, 2020, with eight rotators. So far there has been seven rotation blocks (3 to 4 weeks duration) with rotators assisting BPDIC staff with COVID-19 calls. From March 24, 2020 through July 31, 2020, a total of 59 rotators have provided over 1,200 staffing hours and answered 4,892 (15.7%) of the 31,178 COVID-19-related calls by BPDIC. BPDIC also had a press release about the program with local media interviewing several rotators, with one stating: “It's very humbling to know that we're entering residency in the middle of this international crisis that no one has ever seen before. ... I'm excited to be able to learn.”

TIMELINE

- Jan 6: BPDIC offers assistance to AZDHS and MCDPH
- Jan 26: First COVID-19 patient identified in Arizona
- Feb 11: AZDHS begins referring callers to the Poison Center Help Line (800) 222-1222
- Mar 11: Statewide Coronavirus Information Hotline (844) 542-8201 goes "live"
- Mar 17: BPDIC offers the COVID-19 rotation for GMES to assist with managing the hotline
- Mar 24: First GME rotators attend an orientation lecture for the new COVID-19 program

DISCUSSION

Emergency preparedness planning for poison centers requires nimble staffing solutions for surge capacity. Poison centers should establish relationships with GMES (i.e. nursing, pharmacy, medical) programs to help increase potential staffing and educational resources. Other resource pools include emergency (pre-hospital) medical services and undergraduate students.

SUMMARY

An established relationship between BPDIC, MCDPH and ADHS resulted in the rapid development and deployment of a public health hotline using existing PCC infrastructure. Local GMES can both learn and serve in a poison center’s involvement in public health (including infectious disease) threats.
Outcomes in Unintentional Exposures to Salicylate and Non-salicylate-containing Essential Oils Reported to U.S. Poison Centers

Ron Kirschner, MD1,2, Tyler Hamilton, DO2, Elizabeth Lyden, MS2, Marcia Rasmussen, RN, CSPI1, Karen Smith, RN, BSN, CSPI1

1Nebraska Regional Poison Center, Omaha, NE 2University of Nebraska Medical Center, Omaha, NE

Background

Essential oils are marketed for topical use or aromatherapy. They are not regulated as drugs so may be regarded by consumers as “natural” and relatively benign, but the degree of toxicity varies between products. The purpose of this study was to compare medical outcomes in unintentional ingestion exposures reported to U.S. poison centers (PCs) between essential oils with and without salicylate content.

Methods

The American Association of Poison Control Centers’ (AAPCC) National Poison Data System (NPDS) was queried for cases with unintentional ingestion exposures to liquid formulations of salicylate-containing essential oils (SCEOs), including wintergreen and birch oil from 1/1/00-12/31/19 with a medical outcome of moderate or major effect, or death. All ages were considered, but cases of intentional self-harm were excluded. Cream or ointment formulations were excluded. NPDS was also queried for unintentional ingestion exposures to miscellaneous essential oils (MEOs) and medical outcomes for the two groups were compared using Fisher’s exact test.

Results

There were 68 patients in the SCEO group, including 5 birch and 63 wintergreen oil exposures. Median age was 39.5 years (range 1-92); 54% were male.

There were 1878 patients in the MEO group. Median age was 3 years (range 3 days - 99 years); 47.6% were male.

Discussion

This study is limited by the fact that we did not have access to individual case narratives; we did know specific clinical effects observed and treatments provided through NPDS documentation.

The determination that a toxic exposure results in mild, moderate, or major effects is made by individual PCs using a formula developed by the AAPCC. An assignment of major suggests potentially life threatening or disfiguring effects, while moderate effects are less dangerous but still require treatment (1).

In some cases information provided to PCs by health care facilities may have been inaccurate, incomplete, or miscoded upon entry into the NPDS database.

Conclusion

Unintentional ingestions of salicylate-containing essential oils are associated with a higher proportion of major effects, and are more likely to be treated in a critical care unit compared with other essential oil products.

Reference

Background

Pennyroyal oil, obtained from the plant Menthe pelegium, has been used as a flea repellant, herbal remedy, and abortifacient. Because the active ingredient pulegone is metabolized by CYP450 enzymes to hepatotoxic metabolites, use as an abortifacient has been associated with liver failure and death. The purpose of this study was to track the incidence of pennyroyal ingestions among pregnant women from 2000 through 2019 and to determine if this was affected by changes in state reproductive law following the 2016 US presidential election.

Methods

The American Association of Poison Control Centers’ National Poison Data System (NPDS) was queried for all intentional pennyroyal ingestions among women of childbearing age who were pregnant by history or had a positive pregnancy test from 1/1/00-12/31/19. State reproductive laws were tracked through www.plannedparenthoodaction.org to determine if the case originated in a state that prohibited abortion prior to 20 weeks gestation.

Results

During the study period pennyroyal ingestions were reported to US poison centers by 39 women from 25 states with a median age of 23 years (range 14-36) and median gestational age by history of 7 weeks (range 4-38). Six patients were admitted to an ICU, 7 to a medical floor, 11 were treated and released, and in 15 cases the patient was lost to follow up or left against medical advice. The most frequent medical outcome was minor effect (n=15). There were 11 patients that were unable to be followed, 4 with moderate effect, 4 who were not followed as minimal effects were expected, 4 with no effect, and one with an unrelated effect. There were no major effects or deaths. Among the clinical effects, there were no reports of aminotransferases >1000 or >100 IU/L.

There were no cases reported in 2015, 2016, 2017, or 2019. The one ingestion in 2018 occurred in a state (Washington) with minimal abortion restrictions.

Discussion

Variations in state reproductive law can disproportionately affect low income women in states with more restrictive laws. Those who can’t afford to travel out of state for termination procedures (typically not covered by insurance) might purchase toxic xenobiotics in attempts to end pregnancies.

This intent might not be captured in an NPDS study because desire to terminate pregnancy may not be revealed to practitioners as the reason for the ingestion, and is not included among standard options offered to explain the circumstances of exposure. Use of pennyroyal as an abortifacient is well known among healthcare professionals due to its association with systemic toxicity, but various other xenobiotics including multiple plant-derived products, hormones, and other pharmaceuticals have been used for this purpose (1,2).

Conclusion

Pennyroyal exposures reported to U.S. poison centers did not increase after the 2016 election. However, alternative approaches may be more appropriate to detect a rise in abortifacient use. These should focus on overdoses in pregnant patients with providers first assessing whether there was intent to end the pregnancy, then determining the agents involved. Alternative databases such as the Toxic Investigators Consortium may offer advantages such as bedside medical toxicologist consult in all cases.

References

2. Chu J. Genitourinary principles (chapter 19), in Nelson LS editor, Goldfrank’s Toxicologic Emergencies 11th edition, 2019
Packaging and Labeling of Salicylate-Containing Essential Oils

Rachel Miceli, MD¹, Karen Smith, RN, BSN, CSPI², Ron Kirschner, MD¹,²

¹Nebraska Regional Poison Center, Omaha, NE ²University of Nebraska Medical Center, Omaha, NE

Background
Oil of wintergreen has long been recognized for its high methyl salicylate content, which may pose a hazard in exploratory pediatric ingestions. Birch oil presents a similar risk. These products are widely available to consumers for topical use or aromatherapy. The purpose of this study was to assess a convenience sample of both products from multiple vendors with regard to warning labels, declaration of ingredients, presence of child resistant closures, and liquid flow rates.

Methods
A convenience sample of products was purchased from internet sites. Labeling was read by investigators to determine whether ingredients were listed, if each product was specifically noted to be “not for internal use”, and consumers were warned to keep away from children, then this information was recorded on a spreadsheet. Each product was tested for presence of a child resistant cap. If a flow restrictor was present, the rate of flow per 30 seconds was measured using a timer.

Results
Seventeen products were assessed; 11 wintergreen oil, and 6 birch oil. Median volume of liquid in the containers was 15 mL (range 5 - 118).

<table>
<thead>
<tr>
<th>Variables</th>
<th>Wintergreen Oil n=11</th>
<th>Birch Oil n=6</th>
</tr>
</thead>
<tbody>
<tr>
<td>Child Resistant Closure</td>
<td>6 (54.5%)</td>
<td>3 (50%)</td>
</tr>
<tr>
<td>Flow Restrictor</td>
<td>7 (63.6%)</td>
<td>5 (83.3%)</td>
</tr>
<tr>
<td>Botanical/Common Plant Name</td>
<td>11 (100%)</td>
<td>6 (100%)</td>
</tr>
<tr>
<td>“Methyl Salicylate”</td>
<td>0 (0%)</td>
<td>1 (16.7%)</td>
</tr>
<tr>
<td>“Keep Out of Reach of Children”</td>
<td>9 (81.8%)</td>
<td>4 (66.7%)</td>
</tr>
<tr>
<td>“Not for Internal Use” or “For External Use Only”</td>
<td>4 (36.4%)</td>
<td>1 (16.7%)</td>
</tr>
</tbody>
</table>

Discussion
Essential oils sold for topical use or aromatherapy are not regulated by the US Food and Drug Administration as drugs. Therefore, compliance with labeling and packaging safety standards is largely voluntary.

Even when such closures are present, consumers might mix oils with other products in open containers, possibly facilitating access by young children.

Conclusion
Salicylate-containing essential oils sold for topical use or aromatherapy may contain warnings to keep away from children and avoid ingestion, but this is not universal. Some are packaged with child resistant closures and/or flow restrictors, but flow rates are variable, potentially allowing a toxic exploratory salicylate ingestion.

References
Timing of embolic phenomena after hydrogen peroxide exposure: a systematic review

Megan Fee1, Katherine G. Akers, PhD1, 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 therapy (HBT) is standard of care for a similar disease process, decompression sickness.
- HBT is recommended for treatment of left sided symptoms (stroke, seizure, myocardial infarction (MI)) from H2O2 exposures.

OBJECTIVE

To review timing of embolic phenomena after H2O2 ingestion using cases in the literature and reported to USPC to inform observation and treatment recommendations

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 also excluded.
- Abstracted data from literature search included: age, sex, volume and concentration of exposure, timing of embolic symptom onset, and type(s) of embolic event.
- Study authors were contacted by email if timing was not documented or unclear in case reports
- Abstracted data was combined with embolic cases from Hatten et al 2017 for analysis (see references)

RESULTS

- Stroke, seizures, MI, hemodynamic instability, and gas emboli in either ventricle, pulmonary arteries or coronary arteries were defined as clinical effects of interest (CEOIs).
- Portal venous gas, GI hemorrhage, and pneumomediastinum were also recorded.
- Repeat cases were eliminated.

Neurologic symptoms

- 70% of CEOIs had neurologic symptoms
- Median time of onset = 30 minutes
- IQR=2, (rang 0 to 72 hours)

Right ventricle gas or hemodynamic instability

- 23% of CEOIs had RV gas or hemodynamic instability
- Median time of onset = immediate (within 15 minutes)
- IQR=1, (range 0 to 12 hours)

Myocardial Infarction

- 10% of CEOIs had MI
- Median time of onset=immediate
- IQR=1, (range 0 to 20 hours)

DISCUSSION

- 6 of the CEOIs had time of onset greater than or equal to 10 hours which were all cases reported to USPCs
- No individual cases from the literature reported a verified CEOI time of onset after 8 h
- 90% of emboli and hemodynamic instability occurred within 10 h and the majority occurred immediately
- Selection/publication bias in literature cases may skew to earlier time of onset whereas imperfect estimation of timing in USPC cases may bias toward later documented times of onset

CONCLUSION

- Potentially reversible embolic phenomena and hemodynamic instability after H2O2 ingestion most often manifests within 8 hours of ingestion; delayed symptoms have been recorded but are infrequent
- This information can help poison centers define the risk of development of embolic phenomena over time and help can inform reasonable observation guidelines until further evidence emerges

REFERENCES

Case Report: Ethosuximide Overdose

Kim PY, Westover RC, Shulman JA
Division of Medical Toxicology, Department of Emergency Medicine, University of Pittsburgh School of Medicine, Pittsburgh, USA

Background

- Ethosuximide is a succinimide derivative anticonvulsant medication typically used in the treatment of absence seizures
- Toxicity is rare - signs and symptoms have previously been reported to include nausea, vomiting, CNS depression, ataxia, stupor, and coma
- No previous case reports have described hypotension or bradycardia
- The pharmacokinetics of ethosuximide show primary hepatic metabolism by CYP3A4 and relatively long half-life up to 30 hours in children and 50-60 hours in adults
- Reports on potential toxicokinetic variance at supratherapeutic doses are limited

Case Report

- 17-year-old male with no significant past medical history transferred from an outside facility approximately six hours after an intentional overdose with ethosuximide in a suicide attempt
- Ingestion of an estimated fifty to sixty 250 mg tablets
- Initially sedated and complaining of nausea and emesis
- Ethosuximide level on day of presentation was 55 mg/L and downtrended to 39 mg/L
- Demonstrated a transient episode of significant bradycardia and hypotension with nadirs of 47 bpm and 51/40 mmHg, respectively. Managed supportively with fluids and antiemetics
- Monitored in the hospital prior to inpatient psychiatric hospitalization

Results

<table>
<thead>
<tr>
<th>Time (Hours)</th>
<th>Ethosuximide Level (mg/L)</th>
</tr>
</thead>
<tbody>
<tr>
<td>6.3</td>
<td>55</td>
</tr>
<tr>
<td>11.6</td>
<td>53</td>
</tr>
<tr>
<td>15.4</td>
<td>51</td>
</tr>
<tr>
<td>21.8</td>
<td>40</td>
</tr>
<tr>
<td>28.2</td>
<td>44</td>
</tr>
<tr>
<td>34.3</td>
<td>39</td>
</tr>
</tbody>
</table>

Discussion

- The purpose of this case report is two-fold: to elucidate previously undescribed sequelae of overdose and to report the observed pharmacokinetics
- After an estimated ingestion of 12,500 to 15,000 mg ethosuximide, initial serum level obtained at 6.3 hours post ingestion was 55 mg/L
- The patient exhibited nausea and emesis with subsequent development of CNS depression
- Transient episode of bradycardia and hypotension, which has not previously been reported in toxicity
- Episode resolved with no evidence of concurrent mental status changes, end organ damage, or other long-term clinical sequelae from ingestion
- Ethosuximide is hepatically metabolized (80%) primarily by CYP3A4 to inactive metabolites, and approximately 10 to 20% may be excreted unchanged in the urine
- Half-life has been reported to be relatively prolonged at 30 hours in children and 50-60 hours in adults
- In this patient, serial ethosuximide levels were obtained suggesting half-life in overdose resembling pharmacokinetic values

Conclusions

- This case report reveals potential additional features of ethosuximide overdose, including hypotension and bradycardia, in addition to those commonly reported. Additionally, the data suggest ethosuximide in overdose continues to undergo prolonged elimination
Background

- Ondansetron is the most common ED antiemetic.
- A 2011 FDA “black-box” warning for dose-related QTc prolongation and Torsades des Pointes (TdP)
- Cases of TdP from smaller doses (4mg IV) are lacking.

Case

- 41 yo F with alcohol use disorder on no medications or supplements presents with nausea, vomiting, SOB, and epigastric pain and tenderness.
- T 36.4°C, HR 77, 129/69 mmHg, RR 19, Sat 100%
- 4mg IV ondansetron, 30mg IV ketorolac given

Discussions

- Ketorolac has not been associated with QT prolongation
- Multiple factors similar at repeat presentation without QT prolongation
- Ondansetron at 4mg IV is the likely causative agent

Conclusions

- QT prolongation with subsequent TdP and cardiac arrest may occur in high-risk patients receiving 4mg of IV ondansetron.

Course

- Witnessed arrest, immediate CPR+ 1mg + Epinephrine + defibrillation → ROSC at 2 min
- 2 g IV Mg given
- 24 hours later EKG, TTE, neuro exam all normal
Background

To continue our Medical Toxicology rotation in light of Coronavirus restrictions we needed to become completely virtual. Our rotation is composed of medical and pharmacy students, residents (mostly emergency medicine), fellows, and attending medical toxicologists and clinical toxicologists.

Methods

All rotating students, residents, fellows and attendings were invited to join in the teleconference. Daily clinical rounds and didactics were held via a standard teleconference link. Clinical rounds consisted of presentations of patients and didactic teaching. Residents from our affiliated hospitals who were in quarantine for Coronavirus and guest toxicologists throughout the US were also invited to join rounds.

We conducted a brief survey of our rotating residents (n=4) and students (n=4) during the transition month to determine their preference for in-person or teleconference rounds.

Survey Questions

1. Was it easy to log into teleconference rounds Y N
2. Did you prefer rounds in-person or via teleconference
   Y N
3. Were you more likely to ask questions in-person or via teleconference
   Y N
4. In teleconference, you preferred to ask questions verbally or by chat
   Y N
5. Were your verbal questions answered Y N
6. Were your chat questions answered Y N

Results

1. Our active Toxicology service was maintained by teleconference
2. Attendings participated more frequently than pre-pandemic.
3. There was no disruption in medical student rotations
4. Our unstructured survey showed:
   Residents preferred teleconference rounds
   Students preferred in-person rounds
   Students preferred to ask questions via the chat function

Conclusion

We made changes by remaining flexible and creative. Teleconferencing allowed our service to be maintained without interruption and improved our daily attendance. There was more participation in case discussions. Medical students had no interruption in their clinical rotation and learning. Teleconferencing is a viable alternative to in-person rounds on our Toxicology service.
Bites from non-native Viperidae and Elapidae snakes reported to the UK National Poisons Information Service (NPIS) between 2009 and 2019


Objective
To review all enquiries to the UK NPIS involving bites from snakes belonging to the Viperidae and Elapidae families. All cases regarding Vipera berus (European adder) which is native to the UK were excluded.

Results
Interrogation of the UK Poisons Information Database between 01/01/2009 and 31/12/2019 retrieved 64 enquiries regarding 42 exposures involving 33 patients (7 of whom were bitten on two separate occasions and one who was bitten on three separate occasions). Of these 42 exposures, 29 involved Viperidae (70%) and 13 involved Elapidae (30%), see Table One.

Viperidae
Exposures to Viperidae involved 24 patients (21 of whom were male). Three patients were bitten by two different Viperidae on two different occasions and one patient was bitten by three different Viperidae on three different occasions. Sixteen bites were from pets, 7 bites occurred in the context of occupational exposure and 6 patients were bitten overseas. Bites from rattlesnakes were most common accounting for 11 exposures. The site of the bite was documented in 27 of 29 exposures, of which 24 occurred on the hand and three on the leg. The maximum Poisoning Severity Score (MAXPSS) was known in 26 exposures; minor (n=9), moderate (n=9) and severe (n=8). Advice was sought from a clinical toxinologist in 20 exposures. Antivenom was administered in 11 exposures (in three antivenom was administered overseas). Follow up was undertaken in 16 exposures. Complete recovery was documented in 11 and the outcome was unknown in 5 (3 of whom self-discharged against medical advice). No deaths were reported.

Elapidae
Exposures to Elapidae involved 11 patients (10 of whom were male); 10 exposures were from cobras. Two patients were bitten by two different Elapidae on two different occasions. Seven bites were from pets, 5 bites occurred in the context of occupational exposure and in one case the circumstances of exposure was unknown. The site of the bite was documented in 9 of the 13 exposures, 6 of which occurred on the hand, and one each on the arm, leg and foot. The MAXPSS was known in 12 exposures; minor (n=7), severe (n=4) and death (n=1). Advice was sought from a clinical toxinologist in 11 exposures. Antivenom was administered in 5 exposures. Follow up was undertaken in 8 exposures with complete recovery in 5, ongoing features (n=1), permanent sequelae (n=1) and one death following a bite from a King Cobra (Ophiophagus Hannah). Antivenom was administered on the scene but the patient died before reaching hospital.

Table 1.
<table>
<thead>
<tr>
<th></th>
<th>Viperidae</th>
<th>Elapidae</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cases</td>
<td>29</td>
<td>13</td>
</tr>
<tr>
<td>MAXPSS ‘Severe’ or ‘Death’</td>
<td>8 (28%)</td>
<td>5 (38%)</td>
</tr>
<tr>
<td>Exposures referred to the clinical toxinologist</td>
<td>20 (69%)</td>
<td>11 (84%)</td>
</tr>
<tr>
<td>Exposures requiring antivenom administration</td>
<td>11 (38%)</td>
<td>5 (38%)</td>
</tr>
</tbody>
</table>

Conclusion
Envenomations from Viperidae or Elapidae are infrequently reported to the UK NPIS with most occurring following bites from pets or in the context of occupational exposure. Severe envenomation has been observed necessitating antivenom administration.
Objective
To review enquiries to the UK NPIS involving bites and stings from animals. Enquiries involving the European adder (Vipera berus) were excluded.

Results
Interrogation of the UK Poisons Information Database between 01/01/2009 and 31/12/2019 retrieved 1,599 enquiries. Most related to chordates (n=850, 53%) followed by arthropods (n= 591, 37%). The remaining 10% of enquiries involved cnidarians (n= 72), echinoderms (n=41), annelids (n=3) and molluscs (n=1). In 41 enquiries the animal was not known.

Of the 850 enquiries regarding chordates, 629 (74%) involved reptiles, including snakes (n=555), lizards (n=71) and turtles (n=3). Of the 591 enquiries regarding arthropods, 502 (85%) involved arachnids, including spiders (n=449), scorpions (n=41), ticks (n=11) and mites (n=1).

More detailed analysis was undertaken for enquiries regarding snakes and spiders since these comprised the majority (63%) of calls.

Snakes
Of 555 snake enquiries, identification was reported in 348. These involved 307 exposures in 296 patients (10 of whom were bitten on multiple occasions). Pet snakes were implicated in at least 248 exposures.

Of 307 snake exposures, the families involved were Colubridae (n=176, 57%), Pythonidae (n= 53, 17%), Boidae (n=34, 11%), Viperidae (n= 29, 9%), Elapidae (n=13, 4%) and other (n=2, 0.7%). The maximum Poisoning Severity Score (MAXPSS) was known in 300 exposures and was none in 80, minor in 182, moderate in 25, severe in 12 and fatal in 1. Only bites from Viperidae (n=8) or Elapidae (n=5) caused severe poisoning or fatality.

The advice of a consultant clinical toxicologist was sought in 58 of 307 snake exposures and 39 of these were further referred to a specialist toxicologist. The severity of poisoning was moderate or worse in 24/39 (62%) cases where toxicology expertise was sought.

Spiders
Of 449 enquiries relating to spiders, identification was reported in 238. These involved 220 exposures in 219 patients (1 patient was bitten on multiple occasions). Pet spiders were implicated in at least 80 exposures.

Of 220 spider exposures, the families were Theridiidae (n= 121, 55%), Theraphosidae (n= 65, 30%) and other (n=34, 15%). MAXPSS was known in 218 exposures and was none in 19, minor in 162, moderate in 36 and severe in 1. The majority of exposures resulting in moderate or severe toxicity (n=25) occurred following bites from Theraphosidae.

The advice of a consultant clinical toxicologist was sought in 43 of 220 exposures and 15 of these were further referred to a specialist toxicologist. The severity of poisoning was at least moderate in 10/15 cases where toxicology expertise was sought.

Conclusion
Bites from snakes and spiders account for the majority of enquiries to the UK NPIS regarding bites and stings. These enquiries pose a challenge for UK poisons information specialists and consultant clinical toxicologists, with specific toxicology expertise sometimes required.
Beware the Miracle Mineral Cure: A case of life-threatening sodium chlorite overdose

McNeill IR\textsuperscript{1,2}, Harris K\textsuperscript{1,2}, Harburg GR\textsuperscript{1,2} and Isoardi KZ \textsuperscript{1,2,3}

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\textsuperscript{2} Faculty of Medicine, University of Queensland, Brisbane, Australia
\textsuperscript{3} Clinical Toxicology Research Group, University of Newcastle, Newcastle, Australia

INTRODUCTION

Sodium chlorite is a chemical used as a bleaching agent and disinfectant. In alternative medicine circles it is marketed as “Miracle Mineral Supplement” a proclaimed curative for illnesses such as HIV, malaria, viral hepatitis and more recently COVID-19. We present a case of deliberate sodium chlorite poisoning resulting in severe toxicity with methemoglobinemia, acute kidney failure and haemolysis.

CASE STUDY

- A 29yo male drank 90g of sodium chlorite flakes dissolved in water with suicidal intention. On arrival to hospital, 30 minutes post ingestion, he appeared cyanosed and diaphoretic with a heart rate of 100bpm, BP of 133/86 mmHg and oxygen saturations of 78% on 10L oxygen. He had profuse diarrhoea.
- Venous gas analysis showed a pH 7.40, pCO2 35mmHg, HCO3 21mmol/L, lactate 3.9mmol/L and methemoglobin 40.5%. He received 2mg/kg of methylene blue following which his methemoglobin concentration fell to 21%. A further 2mg/kg of methylene blue was given 30 minutes later, and his methemoglobin concentration fell to 6.2%.
- He was observed overnight where he was noted to have oliguria. On day two his creatinine rose from 77 µmol/L to 355 µmol/L (RR 60-110 µmol/L). His urine output was only 4mL/h and intermittent hemodialysis was commenced.
- His hemoglobin decreased from 158 g/L to 102 g/L (RR 135-180 g/L) with a lactate dehydrogenase rise of 3630 U/L (RR 120-250 U/L), consistent with hemolysis. The hemolysis progressed to a hemoglobin nadir of 57g/L on day four. He received multiple red cell transfusions between days four and 12 at which point his hemoglobin stabilised [Figure 1].
- He was discharged home on day 13, although he continued to require dialysis three times per week until day 24 when his renal function recovered [Figure 2].

CASE DISCUSSION

Sodium chlorite is a powerful oxidative agent. Overdose is characterised by an early methemoglobinemia followed by haemolysis and acute kidney injury. There is very little data to guide the management of sodium chlorite poisoning, with only a few cases reported in English literature.

The initial use of methylene blue, followed by the supportive management of renal failure and haemolytic anaemia, with dialysis and red cell transfusion respectively were effective in this case.
ASPIRIN OVERDOSE: WHAT IS A REALISTIC RISK ASSESSMENT?

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2Faculty of Medicine, University of Queensland, Brisbane, Australia.
3Clinical Toxicology Research Group, University of Newcastle, Newcastle, Australia.
4Department of Clinical Toxicology and Pharmacology, Calvary Mater Newcastle, Newcastle, Australia

BACKGROUND
Aspirin is a metabolic poison and overdoses cause acid-base disturbance and organ dysfunction. Risk assessment has been based on the recognised severity of chronic poisoning reported over 40 years ago. We investigated the severity of acute aspirin overdose and predictors of toxicity.

METHODS
We undertook a retrospective series of acute aspirin overdoses presenting to two toxicology units from January 2000 to September 2019. Aspirin exposures >3000mg were identified in prospective clinical databases from toxicology presentations. Clinical notes were reviewed to obtain demographic data, clinical effects, investigations, complications and treatment.

RESULTS
There were 170 cases in 143 patients (98 females [69%]) with a median age of 28 years (Interquartile range [IQR]: 20-44 years). Patients presented a median of 3.5 h (IQR: 1.7-7.2 h) post ingestion following a median aspirin ingestion of 7200 mg (Range 3300-86400 mg). Co-ingestions were taken in 131 (77%) presentations. Charcoal was given in 37 (22%) presentations a median of 3.0 h (IQR: 2-4.5 h) post-ingestion.

Common clinical features were tinnitus in 36 patients (21%), vomiting in 45 (26%) and tachypnoea (respiratory rate > 20 breaths per minute) in 61 (36%). Confusion, coma (GCS < 9) and hypotension occurred in 15 (9%), 9 (5%) and 17 (10%) cases respectively, although in most cases these were attributable to co-ingestions. A bicarbonate <20 mmol/L occurred in 38 (22%) presentations.

The median peak aspirin concentration was 276 mg/L (IQR: 168-400 mg/L). There was a strong association between dose ingested and peak concentration (Pearson r=0.55; p<0.0001 [Figure 1]). There was a small negative association between dose ingested and bicarbonate (Pearson r=−0.21; p=0.012 [Figure 2]).

CONCLUSIONS
Acute aspirin overdose caused only mild toxicity in most cases. There were few cases of severe toxicity with peak salicylate concentrations >700mg/L, all ingesting doses >300mg/kg. Both salicylate concentration and bicarbonate were associated with dose ingested.
VIRTUAL TOXICOLOGY SERVICE: DEVELOPING A NEW MODEL OF SPECIALTY CARE
McNeill IR1,2, Staib AN2, Harris K1,2 and Isoardi KZ1,2.

1Clinical Toxicology Unit, Princess Alexandra Hospital, Brisbane, Australia
2Faculty of Medicine, University of Queensland, Brisbane, Australia

BACKGROUND
Toxicology services have long been pioneers in Telehealth with Poisons Information Centres and Clinical Toxicology Units providing centralised specialist advice over a wide geographical area. This advice has traditionally been given via telephone with consultations. With the introduction of a fully integrated electronic medical record (iEMR) across Metro South Health Service in Queensland we sought to examine the introduction of a Virtual Toxicology Service at a regional centre.

METHODS
We prospectively collected data for the first three months of a pilot Virtual Toxicology Service delivered by Princess Alexandra Hospital Clinical Toxicology Unit. The pilot site, Logan Hospital is a regional hospital in the same health service that was chosen as it is the most frequent user of the phone consultation service. A Virtual Ward Round was performed daily at 8am. Patients in the emergency department with a toxicological presentation were identified in the iEMR. Their history, examination findings, vital signs, medication and fluid charts, pathology results, imaging and ECGs were reviewed in order to determine a risk assessment and management advice. This was then documented directly into the patient’s chart. This was followed by a phone call to the in charge emergency physician to confirm the advice was received.

RESULTS
Over the first 3 months of the pilot Virtual Toxicology Service there were 127 virtual ward round consultations [Table 1]. Deliberate self-poisonings accounted for two thirds of presentations with the commonest exposures being paracetamol, quetiapine and ibuprofen. Recreational intoxication accounted for 24% of presentations which were largely following methamphetamine use. There were 12 unintentional exposures which included four suspected snakebites. Advice given, in addition to specifying minimum observation periods and discharge criteria in each case included [Figure 1];
• specific toxicological interventions such as decontamination techniques or antidote administration,
• good supportive care; including any monitoring requirement
• identifying suitability for discharge from a toxicological perspective (medical clearance) at the time of the virtual ward round.

Table 1: Baseline characteristics of Virtual Ward Round Presentations

<table>
<thead>
<tr>
<th>Male (%)</th>
<th>63 (50%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Median age (Range)</td>
<td>29 years (2 – 71 years)</td>
</tr>
<tr>
<td>Intent (%)</td>
<td></td>
</tr>
<tr>
<td>Self-poisoning</td>
<td>85 (67%)</td>
</tr>
<tr>
<td>Recreational</td>
<td>20 (24%)</td>
</tr>
<tr>
<td>Unintentional</td>
<td>12 (9%)</td>
</tr>
<tr>
<td>Commonest Exposures [%]*</td>
<td></td>
</tr>
<tr>
<td>Paracetamol</td>
<td>27 (21%)</td>
</tr>
<tr>
<td>Methamphetamine</td>
<td>23 (18%)</td>
</tr>
<tr>
<td>Alcohol</td>
<td>17 (13%)</td>
</tr>
<tr>
<td>Quetiapine</td>
<td>16 (13%)</td>
</tr>
<tr>
<td>Ibuprofen</td>
<td>15 (12%)</td>
</tr>
<tr>
<td>Diazepam</td>
<td>14 (11%)</td>
</tr>
<tr>
<td>Marijuana</td>
<td>5 (4%)</td>
</tr>
<tr>
<td>Snakebite</td>
<td>4 (3%)</td>
</tr>
<tr>
<td>*Multiple exposures could occur in a single presentation</td>
<td></td>
</tr>
</tbody>
</table>

CONCLUSION
A Virtual Toxicology Service is feasible with an integrated electronic medical record and can aid the delivery of toxicological advice to hospitals without a clinical toxicology service. Bringing the toxicologist to the patient virtually can optimize the care of poisoned patients. Future research will focus on a more detailed evaluation of the impact of the service on both patient outcomes and resource utilization at remote sites.
Predatory Insulin Administration in Drug Facilitated Sexual Assault

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Indiana University School of Medicine, Department of Emergency Medicine\textsuperscript{1}, Division of Medical Toxicology\textsuperscript{2}

**Background**

- Exogenous insulin use has been reported in many cases of self harm, but less frequently in cases of assault.
- We report what we believe is the first case of predatory insulin administration for drug facilitated sexual assault.

**Case Presentation**

- 16 yo F with history of neurofibromatosis presented to the Emergency Department after alleged physical assault.
- On physical exam, she had normal vital signs, and abrasions and soft tissue swelling noted to face, right arm, and right chest.
- While awaiting radiology, patient had an abrupt onset of altered mental status and a tonic-clonic seizure.
- Rapid glucose was <20 mg/dL.
- After 2 mg lorazepam and 25 gm dextrose, seizure stopped.
- Shortly afterward, dextrose was again measured at 38 mg/dL.
- Patient admitted and toxicology consulted.

**Case Conclusion**

- High insulin level, low C peptide and undetectable Pro-insulin diagnostic of exogenous insulin administration.
- Octreotide administered for a total of 12 doses until sulfonylurea panel returned negative.
- Patient ultimately disclosed a history of forced sexual encounters.
- Child protective services, local law enforcement, and the FBI were involved in the investigation of suspected human trafficking.

**Discussion**

- Case reports of massive insulin overdose result in prolonged hypoglycemia as in our case.
- Dextrose requirement varies based on patient factors as well as dose and type of insulin.
- Prolonged and profound hypoglycemia in this case supports the administration of a large dose of a likely long acting agent.

### Table

<table>
<thead>
<tr>
<th>Day</th>
<th>Dextrose</th>
<th>Octreotide</th>
<th>Glucose range mg/dL</th>
<th>Toxicology results</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>D50 x 8 doses D12.5% 200 mL/H</td>
<td>50 mcg q6H</td>
<td>20-118</td>
<td>Insulin 602 mcU/mL C peptide 0.5 ng/mL Pro-insulin negative</td>
</tr>
<tr>
<td>2</td>
<td>D50 x 1 dose D15% 100-200 mL/H</td>
<td>50 mcg q6H</td>
<td>50-110</td>
<td></td>
</tr>
<tr>
<td>3</td>
<td>D50 x 1 dose D15% 125-190 mL/H</td>
<td>50 mcg q6H</td>
<td>37-200s</td>
<td>Insulin 158 mcU/mL C peptide 2.0 ng/mL Sulfonylurea panel negative</td>
</tr>
<tr>
<td>4</td>
<td>No D50 D15% 100-175 mL/H</td>
<td>50 mcg q6H</td>
<td>16-300s</td>
<td></td>
</tr>
<tr>
<td>5</td>
<td>No D50 D15% 125-175 mL/H</td>
<td>none</td>
<td>68-120</td>
<td></td>
</tr>
<tr>
<td>6</td>
<td>No D50 D15% 60-150 mL/H, weaned to off</td>
<td>none</td>
<td>83-117</td>
<td></td>
</tr>
</tbody>
</table>

![Figures 1 and 2 – radiology showing subcutaneous air at site of likely administration, and soft tissue swelling in the corresponding location on arm](image-url)
Prolonged Status Epilepticus in a Child following Ingestion of Methomyl
Christopher P. Holstege, M.D. & Mary Bacon, M.D.
Division of Medical Toxicology/Department of Emergency Medicine, University of Virginia School of Medicine, Charlottesville, Virginia, U.S.A.

Background
Methomyl is a carbamate insecticide. There are few reports of human toxicity following ingestion. We present a case of methomyl poisoning in a child with a unique clinical course.

Case Report
A 17 kg four year-old swallowed a “little bit” of liquid, later confirmed to be methomyl, from a bottle he misidentified at time 1915. He presented to the emergency department (ED) at 1955 with pulse 108, respiratory rate 20, blood pressure 100/66, and temperature 36.4°C. The child was asymptomatic with no significant examination findings except hydrocarbon breath odor. At 2012, the child had a grand mal seizure and became incontinent of stool. The child continued with intermittent seizures despite repetitive pharmacological intervention. Laboratory values obtained at 2015 demonstrated normal basic metabolic panel and complete blood count. A nasogastric tube was placed at 2025 with 30 ml saline lavage followed by administration of 12.5 grams activated charcoal. An arterial blood gas (ABG) at 2020 revealed: pH 7.24, PCO₂ 54.6, pO₂ 250 on 4 liters nasal cannula oxygen. A bag-valve mask (BVM) was applied after saturations dropped to 70% at 2055. An ABG at 2057 revealed: pH 7.00, PCO₂ 105, pO₂ 203. At 2115, the saturations were 88% with BVM, pulse 168, and blood pressure 150/92. The patient was intubated emergently at 2115 with oxygen saturations increased to 100% and a pulse 175. A third ABG at 2134 revealed: pH 7.31, PCO₂ 28.0, pO₂ 428. A post-intubation chest x-ray was unremarkable. From the time of seizure onset to leaving the ED, the child received diazepam (10 mg), lorazepam (3 mg), phenytoin (340 mg), and phenobarbital (330 mg).

The child was transported to a tertiary care facility with continual seizures from 2155 to 2241 and received additional lorazepam (7 mg). Upon arrival to the intensive care unit, vitals were: T 39.7°C, P 180, BP 109/37, and RR 40 with 97% saturations while bagged. Examination at time of arrival revealed pupils 3 mm, increased salivation, lungs clear, and grand mal status epilepticus. An emergent EEG revealed status epilepticus and pharmacotherapy was administered until generalized bursts of fast and spike discharges ceased. Over the next 24 hours, the child received additional phenobarbital (890 mg), phenytoin (200 mg), lorazepam (6 mg) as well as atropine (0.4 mg), vecuronium (4 mg) and sodium bicarbonate (60 mEq). Within an hour of admission, the child became progressively hypotensive requiring vasopressors. An initial head CT was unremarkable. Two days later, papilledema was noted and a follow-up CT demonstrated diffuse cerebral edema and loss of ventricles. The child was declared brain dead 4 days after the ingestion and life support was removed.

Case Discussion
There are limited methomyl poisonings reported in children. This case is unique in the development of prolonged status epilepticus in a child following carbamate ingestion that was resistant to initial pharmacologic therapy and required phenobarbital-induced coma.

Conclusions
Methomyl poisoning in children can induce status epilepticus highly resistant to pharmacologic therapy.
Glow product-related injuries treated at emergency departments
Lizbeth Petty, Kelly Hogue, Mathias B. Forrester
North Texas Poison Center, Dallas, TX, USA, Independent Researcher, Austin, TX, USA

Background
- Glow (chemiluminescent) products, such as glow jewelry and glow sticks, provide heatless chemical luminescence in a variety of colors.
- The active ingredients in many of these products are anthracene and oxalates synthesized with dibutyl phthalate.
- Although generally considered non-toxic, some injuries resulting from glow products may be treated at emergency departments (EDs).
- The objective of this study was to describe glow product-related injuries managed at United States (US) EDs.

Methods
- Data were obtained from the National Electronic Injury Surveillance System (NEISS), a database of consumer product-related injuries collected from the EDs of approximately 100 US hospitals.
- National estimates are calculated from the database records based on the sample weight assigned to each case based on the inverse probability of the hospital being selected for the NEISS sample.
- Glow product-related injuries reported during 2001-2018 were identified by reviewing the two narrative text fields for any mention of “glow” or “light” and “stick” or “necklace” or “bracelet” or “jewelry.”
- The distribution of estimated glow product-related injuries was determined for various factors related to patient demographics, injury circumstances, diagnosis, and disposition.

Results
- A total of 224 glow product-related injuries were identified, resulting in a national estimate of 8,215 injuries.
- The annual estimate declined during 2001-2007 then increased during 2008-2018.
- The highest proportion (n=1,742, 21.2%) of the injuries were treated during July, followed by November (n=1,463, 17.8%) and October (n=847, 10.3%).
- Most (n=4,601, 56.0%) of the injuries were treated during Friday-Sunday.

Results cont.
- Of the estimated 5,024 injuries with a reported location, 4,027 (80.2%) occurred at home, 483 (9.6%) place of recreation or sports, 308 (6.1%) other public property, 136 (2.7%) school, and 70 (1.4%) street or highway.

Conclusion
- The estimated number of glow product-related injuries treated at EDs has increased over the last decade.
- The injuries were most often treated during July, October, and November and during Friday-Sunday.
- The patients were most often age 0-5 years and male.
- The majority of the injuries affected the eye.
- Most patients were treated or evaluated and released from the ED.
BACKGROUND

- Carbon monoxide (CO) poisoning is a common accidental and preventable death
- Cooking with solid fuels and poorly ventilated houses put Nepalese at risk
- No mechanism for measurement of CO poisoning at Patan Hospital exists and utility is unknown
- Void in studies on CO poisoning in Nepal

OBJECTIVES

- Determine incidence of CO poisoning in patients presenting to Patan Hospital Emergency Department.
- Determine risk factors for CO poisoning.
- Determine baseline levels of COHb (carboxyhemoglobin) levels in patients based off smoking status.

MATERIALS and METHODS

- A prospective observational study of patient ≥ 18 years of age presenting to Patan Hospital Emergency Department over one year.
- Demographic information age, gender, smoking status, vital signs, COHb level, chief complaint, occupation, cooking source, and number of windows was collected.
- Provider gave pre-test probability of CO poisoning.
- COHb level was recorded using noninvasive Rad57 Masimo. CO poisoning defined as level > 10%.
- Trends were analyzed between different risk factors using independent sample T test.

RESULTS

Table 1. Patient demographics with COHb recordings.

<table>
<thead>
<tr>
<th>Total Recordings</th>
<th>Count (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>Average COHb (%)</td>
</tr>
<tr>
<td></td>
<td>7.21</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Age Range</th>
<th>Count (%)</th>
<th>Average COHb (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>18-19</td>
<td>58 (8%)</td>
<td>7.25</td>
</tr>
<tr>
<td>20-29</td>
<td>176 (23%)</td>
<td>7.15</td>
</tr>
<tr>
<td>30-39</td>
<td>129 (17%)</td>
<td>7.90</td>
</tr>
<tr>
<td>40-49</td>
<td>107 (14%)</td>
<td>6.79</td>
</tr>
<tr>
<td>50-59</td>
<td>92 (12%)</td>
<td>7.16</td>
</tr>
<tr>
<td>60-69</td>
<td>90 (12%)</td>
<td>7.01</td>
</tr>
<tr>
<td>70-79</td>
<td>62 (8%)</td>
<td>7.97</td>
</tr>
<tr>
<td>80+</td>
<td>34 (5%)</td>
<td>5.47</td>
</tr>
<tr>
<td>Female</td>
<td>407 (55%)</td>
<td>8.91</td>
</tr>
<tr>
<td>Male</td>
<td>338 (45%)</td>
<td>7.50</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Smoker</th>
<th>Count (%)</th>
<th>Average COHb (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Nonsmoker</td>
<td>515 (69%)</td>
<td>7.19</td>
</tr>
<tr>
<td>Quit Smoking</td>
<td>77 (10%)</td>
<td>7.10</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Count (%)</th>
<th>Average COHb (%)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer/Outdoor - Based Occupation</td>
<td>128 (17%)</td>
<td>7.92</td>
</tr>
<tr>
<td>Home/Home - Based Occupation</td>
<td>336 (45%)</td>
<td>7.23</td>
</tr>
<tr>
<td>Office/Merchant Occupation</td>
<td>283 (38%)</td>
<td>7.14</td>
</tr>
<tr>
<td>Warm Months</td>
<td>425 (57%)</td>
<td>8.13</td>
</tr>
<tr>
<td>Cold Months</td>
<td>320 (43%)</td>
<td>5.99</td>
</tr>
</tbody>
</table>

Table 2. Information of patients with COHb > 10%

<table>
<thead>
<tr>
<th>Gender</th>
<th>Percentage of Total (n = 745)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Female</td>
<td>30%</td>
</tr>
<tr>
<td>Male</td>
<td>32%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Season</th>
<th>Percentage of Total (n = 745)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Warm Months</td>
<td>37%</td>
</tr>
<tr>
<td>Cold Months</td>
<td>22%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Cooking Source</th>
<th>Percentage of Total (n = 745)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Firewood (n=88)</td>
<td>38%</td>
</tr>
<tr>
<td>Gas (n=613)</td>
<td>30%</td>
</tr>
</tbody>
</table>

<table>
<thead>
<tr>
<th>Occupation</th>
<th>Percentage of Total (n = 745)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Farmer/Outdoor - Based Occupation</td>
<td>31%</td>
</tr>
<tr>
<td>Home/Home - Based Occupation</td>
<td>29%</td>
</tr>
<tr>
<td>Office/Merchant Occupation</td>
<td>23%</td>
</tr>
<tr>
<td>High Pre-test Probability</td>
<td>5%</td>
</tr>
</tbody>
</table>

Table 3. History of patients with high pre-test probability of CO poisoning.

<table>
<thead>
<tr>
<th>History</th>
<th>Number of Patients</th>
</tr>
</thead>
<tbody>
<tr>
<td>Syncope/Cardiac Arrest in shower with gas geyser</td>
<td>1 (1 unreadable value)</td>
</tr>
<tr>
<td>Symptoms after sleeping/found down in enclosed room with heating and no ventilation</td>
<td>11 (2 unreadable values, presented with a family member with same symptoms with elevated value)</td>
</tr>
<tr>
<td>Cardiac Arrest – found in sauna</td>
<td>2 (both unreadable values)</td>
</tr>
</tbody>
</table>

Graph 1. Average COHb levels over 12 months. Levels over the cold months (October – February) were lower than in the warmer months (March – September).

Graph 2. A correlation (r=0.91) exist between average COHb recordings and average daily temperatures when controlling for same cooking source and number of windows in the home (n= 333).

Graph 3. During cold months we observed a negative correlation between number of windows in the patients’ homes and average COHb while no such correlation existed during warmer months.

SUMMARY

- Average COHb was 7.2%
- Incidence of COHb > 10% in 31%
- Warm months showed a higher COHb compared to cold months (6.12% vs. 5.99%, p<0.05)
- Incidence of COHb > 10% was higher (37% vs. 22%) depending on season.
- Firewood increased baseline COHb compared to gas (8.51% vs 7.05%, P<0.05) and incidence of COHb > 10% (38% vs 30%).
- Strengths: year-round data collection
- Limitations: Rad 57 Masimo, no gold standard performed, final diagnosis and heating source not obtained

CONCLUSION

CO poisoning should remain on the provider’s differential during warm months.

FUTURE RESEARCH

- Seasonal household behavior involving ventilation and cooking source
- COHb > 10% and final diagnosis in Nepalese population

REFERENCES