Palytoxin Poisoning via Inhalation in Pediatric Siblings

Martha M. Rumore
Touro College of Pharmacy, martha.rumore@touro.edu

Blaine M. Houst

Follow this and additional works at: https://touroscholar.touro.edu/tcopny_pubs
Part of the Marine Biology Commons, and the Pathological Conditions, Signs and Symptoms Commons

Recommended Citation

This Article is brought to you for free and open access by the Touro College of Pharmacy (New York) at Touro Scholar. It has been accepted for inclusion in Touro College of Pharmacy (New York) Publications and Research by an authorized administrator of Touro Scholar. For more information, please contact carrie.levinson2@touro.edu.
Palytoxin poisoning via inhalation in pediatric siblings

Martha M Rumore, Blaine M Houst

ABSTRACT

Introduction: Several cases of palytoxin poisoning have occurred during cleaning of aquariums.
Case Report: We report a case of palytoxin inhalational toxicity in pediatric siblings following secondary exposure to vapors from cleaning of an aquarium containing Zoanthids. Symptoms included fever, tachycardia, leukocytosis and elevated lactic dehydrogenase. Both patients received supportive treatment in the pediatric intensive care unit and were discharged after 48 hours. Symptoms also occurred in children’s parents including cleaning attendant.
Conclusion: Herein, we present a rare case of inhalational toxicity from palytoxin.
Palytoxin poisoning via inhalation in pediatric siblings

Martha M Rumore, Blaine M Houst

ABSTRACT

Introduction: Several cases of palytoxin poisoning have occurred during cleaning of aquariums. Case Report: We report a case of palytoxin inhalational toxicity in pediatric siblings following secondary exposure to vapors from cleaning of an aquarium containing Zoanthids. Symptoms included fever, tachycardia, leukocytosis and elevated lactic dehydrogenase. Both patients received supportive treatment in the pediatric intensive care unit and were discharged after 48 hours. Symptoms also occurred in children's parents including cleaning attendant. Conclusion: Herein, we present a rare case of inhalational toxicity from palytoxin.

Keywords: Palytoxin, Pediatric, Inhalation, Aquarium, Zoanthids

INTRODUCTION

Zoanthid corals are often found in sea water aquaria. Touching the zoanthid corals results in palytoxin poisoning in patients with skin injuries and also through intact skin [1, 2]. Several cases of palytoxin poisoning have occurred during cleaning of aquarium by inhaling a water aerosol where toxin is dissolved [3, 4]. Herein, we report a case of inhalational toxicity affecting pediatric patients, as well as involving multiple individuals following cleaning of an aquarium. To our knowledge, this represents the first case of elevated lactic dehydrogenase (LDH) following inhalational exposure and the third case of leukocytosis.

CASE REPORT

A three-year-old boy and his two-month-old sister presented to the emergency department, both febrile after vomiting at home. The three-year-old also presented with tachycardia (heart rate 120 beats per minutes), cough and sleepiness whereas the two-month-old did not have cough, the cough reflex is unreliable at this age. Both patients had no known allergies. Since the children’s parents were also ill with vomiting and a feeling of being hungover, an initial diagnosis of unspecified food poisoning was made. The symptoms occurred after their aquarium attendant washed the coral in the tank with hot water. A short while after, the parents were both vomiting.
and felt hungover while the children both vomited and spiked temperatures. The family received a call by the tank company three hours after the attendant left, were informed that the attendant was in emergency department with similar symptoms, and advised to seek medical treatment. At that point, palytoxin poisoning was suspected; both children were ultimately admitted to the pediatric intensive care unit (PICU).

On admission, chest X-rays and electrocardiograms of both the children were normal and oxygen saturation was 97% for both. Upon examination, both children showed leukocytosis and elevated LDH on blood analysis including elevated white blood cells. White blood cells of three-year-old was 34,000/μL and LDH levels was 331 U/L whereas white blood cells of two-month-old was 34,400/μL and LDH levels was 507 U/L (normal range 135–225 U/L). Laboratory examination of the three-year-old boy also revealed the following: elevated serum phosphorus 4.9 mg/dL, creatine kinase 78 U/L (normal 30–200 U/L), proteinuria 10 mg/dL. Alkaline phosphatase and all other laboratory values were normal.

The two-month-old female developed symptoms earlier than her brother and was considered more sick. Her laboratory values were more elevated than her brother. Her laboratory examination revealed the following: serum phosphorus 5.8 mg/dL, potassium 5.5 mmol/L, creatine kinase 169 U/L, aspartate aminotransferase/alanine aminotransferase (AST/ALT) 57/50 U/L (normal 0–31 U/L), proteinuria 20 mg/dL. Mild metabolic acidosis was present—urine pH 6.5, blood pH 7.36, bicarbonate 17 mmol/L. The urine was hazy with trace blood. The patient was tachycardic (heart rate 156 beats per minutes) and hypotensive (blood pressure 102/65 mmHg). An echocardiogram on the two-month-old girl showed no findings. For both patients, serial extended monitoring of electrolyte levels was conducted.

Supportive therapy was given during the hospital stay, and the complete blood count and metabolic panels began to normalize. Both children received hydration (D5 ½ NS at 50 mL/hr); a one-time dose of acetaminophen suspension was administered to the three-year-old boy for a fever (100.4°F). The boy also received calamine lotion every 8 hours and diphenhydramine cream 1% for mosquito bites. Within the next 24–48 hours, some of the laboratory values normalized while others remained elevated. The three-year-old was discharged 48 hours after admission with white blood cell 24,800/μL, creatine kinase 39 U/L, and LDH 253 U/L whereas the two-month-old was discharged at the same time with white blood cell 8,700/μL, creatine kinase 115 U/L and mildly elevated LDH 285 U/L.

Both children were discharged from the hospital within 48 hours.

**DISCUSSION**

Currently, there are no restrictions on the importation of toxic marine organisms into the United States if they are not ingested. Records regarding Zoanthidea are also not required. In some cases, Zoanthidea are not purchased at all, but are merely contaminants growing on rock or coral (e.g. frags). Recently, specimens of Zoanthids collected from home aquarium stores were analyzed and found to be highly toxic with palytoxin [5]. Palytoxin (C₁₉₆H₂₂₃N₅O₄₅), first isolated in 1971, is one of the largest and most complex natural products and is the second deadliest toxin known to man with an LD₅₀ of 300 ng/kg in mice, 2 mg of toxin could kill 300,000 mice [5–7]. A toxic dose in humans may be about 4 μg. However, there are no reliable quantitative data on acute toxicity in humans. In our case, both identification of the toxin and quantification of levels were not performed, and palytoxin was implicated based on the exposure to Zoanthids and clinical symptomology. Palytoxin is one of the only marine toxins that are toxic to humans via ingestion, inhalation or dermal exposure. The toxin is heat stable and boiling or hot water used in cleaning aquaria does not inactivate the toxin.

Palytoxin binds to Na, K-ATPase, resulting in transformation of the sodium pump into a non-specific ion channel for monovalent cations causing a wide spectrum of secondary pharmacological actions [8]. More specifically, an increase in sodium may stimulate calcium-independent superoxide anions and oxidative stress, leading to cellular death [9]. The toxicity can be severe affecting multiple organ systems and takes place after a short-time of exposure at very low concentration. Clinically, patients can develop paresthesia, hypertension, dysgeusia, nausea, vomiting, diarrhea, rhabdomyolysis, cardiac dysrhythmias, respiratory depression, coma and death [10, 11].

Most cases involving aquarium Zoanthids have involved dermal exposure [1, 2, 12, 13]. While inhalational toxicity from marine aerosols is well known, the first case of inhalational toxicity from aquaria was reported in 2008, a second case was reported in 2010, and a third case in 2012 [3, 4, 14, 15]. This case report represents the fourth case of inhalational toxicity incidental to aquarium Zoanthids.

Very few data is available regarding inhalational toxicity. In 2003, 2006 and 2008 outbreaks of inhalational toxicity from blooms of algae occurred in Europe and the Mediterranean sea. All those affected needed medical attention for high fever, coughs and wheezing [16, 17]. Therefore, exposure to aerosolization results mostly in respiratory illness, fever, mild dyspnea, bronchoconstriction, cough, sore throat, headache, rhinorrhea, lacrimation, expectoration, myalgia, arthralgia, dermatitis, odynophagia, fatigue, dry throat and, occasionally, conjunctivitis. There are anecdotal reports in online marine aquarium forums of individuals poisoned via inhalation from cleaning organisms or
aquaria under steaming water. However, there are only a few published case reports of inhalational palytoxin toxicity from exposure to aquarium Zoanthids. The cases are summarized in Table 1.

In our case, the cleaning attendant became sick first, followed by the parents, and then the two children. The parent’s complaint of feeling hungover is consistent with previous reports of poisoning from contact with aquarium Zoanthids. In one case, the patient exhibited dizziness, slurred speech, and glassy eyes [1]. Clearly, the symptoms in the adults in this case were of lesser severity than that in the children. Additionally, the two-month-old female developed symptoms earlier than her brother and was considered more sick. This would indicate greater susceptibility. However, the paucity of reported cases in children does not permit a comparison of inhalational toxicity from palytoxin in adults and children.

Creatine kinase levels of approximately 1000 U/L are suggestive of rhabdomyolysis. Creatine kinase levels were normal in the three-year-old, but mildly elevated in the two-month-old. However, elevated LDH in our patients may be indicative of mild rhabdomyolysis which was asymptomatic. Rhabdomyolysis is one of the most dangerous complications of palytoxin poisoning because it can lead to acute renal failure. Both patients also had hyperkalemia which is an early and fast-rising manifestation of rhabdomyolysis and mild hyperphosphatemia.

While all the cases were presumptive, the appearance of symptoms in five individuals simultaneously after cleaning an aquarium is highly suggestive of palytoxin toxicity.

Although animal studies have shown that vasodilators, such as papaverine and isosorbide dinitrate, can be used as antidotes if injected directly into the heart immediately following exposure [18], there is no specific antidote for palytoxin poisoning. Treatment is supportive. Both patients received hydration and were closely monitored in the PICU.

### CONCLUSION

Zoanthids are commonly sold by pet stores and found in home aquaria. Precautions should be taken as palytoxin can travel in water vapor and cause poisoning by inhalation. Cases of palytoxin toxicity via inhalational route, while rare, do occur. Exposure is characterized by vomiting, leukocytosis, elevations in lactic dehydrogenase, sometimes creatine kinase, and a febrile syndrome.

<table>
<thead>
<tr>
<th>Case Reports</th>
<th>Symptoms</th>
<th>Laboratory Findings</th>
<th>Treatment</th>
</tr>
</thead>
<tbody>
<tr>
<td>Snoeks and Veenstra, 2012</td>
<td>Fever, hypotension, metallic taste, nausea, headache, shivering, muscle cramps, leukocytosis, elevated CRP</td>
<td></td>
<td></td>
</tr>
<tr>
<td>Deeds and Schwartz, 2010 (occurred 2007)</td>
<td>Difficulty breathing, lightheadedness, chest pain, bronchial inflammation and bronchoconstriction, temperature not reported.</td>
<td>No creatine phosphokinase levels reported</td>
<td>Antihistamine, inhaled corticosteroid, analgesic, cough suppressant</td>
</tr>
<tr>
<td>Majilesi, 2008</td>
<td>Shortness of breath, chest pain, tachycardia, BP 140/80 mmHg, afebrile, respiratory rate 24, 100% oxygen saturation, wheezing, EKG-sinus tachycardia</td>
<td>Metabolic panel and cardiac enzymes were normal; leukocytosis (WBC 21,000/μL)</td>
<td>Nebulized albuterol</td>
</tr>
</tbody>
</table>

### Author Contributions
Martha M Rumore – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published
Blaine M Houst – Substantial contributions to conception and design, Acquisition of data, Analysis and interpretation of data, Drafting the article, Revising it critically for important intellectual content, Final approval of the version to be published

### Guarantor
The corresponding author is the guarantor of submission.

### Conflict of Interest
Authors declare no conflict of interest.

### Copyright
© 2014 Martha M Rumore et al. This article is distributed under the terms of Creative Commons Attribution License which permits unrestricted use, distribution and reproduction in any medium provided the original author(s) and original publisher are properly credited. Please see the copyright policy on the journal website for more information.
REFERENCES

Edorium Journals: An introduction

Edorium Journals Team

About Edorium Journals
Edorium Journals is a publisher of high-quality, open access, international scholarly journals covering subjects in basic sciences and clinical specialties and subspecialties.

Invitation for article submission
We sincerely invite you to submit your valuable research for publication to Edorium Journals.

But why should you publish with Edorium Journals?
In less than 10 words - we give you what no one does.

Vision of being the best
We have the vision of making our journals the best and the most authoritative journals in their respective specialties. We are working towards this goal every day of every week of every month of every year.

Exceptional services
We care for you, your work and your time. Our efficient, personalized and courteous services are a testimony to this.

Editorial Review
All manuscripts submitted to Edorium Journals undergo pre-processing review, first editorial review, peer review, second editorial review and finally third editorial review.

Peer Review
All manuscripts submitted to Edorium Journals undergo anonymous, double-blind, external peer review.

Early View version
Early View version of your manuscript will be published in the journal within 72 hours of final acceptance.

Manuscript status
From submission to publication of your article you will get regular updates (minimum six times) about status of your manuscripts directly in your email.

Our Commitment

Six weeks
You will get first decision on your manuscript within six weeks (42 days) of submission. If we fail to honor this by even one day, we will publish your manuscript free of charge.

Four weeks
After we receive page proofs, your manuscript will be published in the journal within four weeks (31 days). If we fail to honor this by even one day, we will publish your manuscript free of charge and refund you the full article publication charges you paid for your manuscript.

Mentored Review Articles (MRA)
Our academic program “Mentored Review Article” (MRA) gives you a unique opportunity to publish papers under mentorship of international faculty. These articles are published free of charges.

Most Favored Author program
Join this program and publish any number of articles free of charge for one to five years.

Favored Author program
One email is all it takes to become our favored author. You will not only get fee waivers but also get information and insights about scholarly publishing.

Institutional Membership program
Join our Institutional Memberships program and help scholars from your institute make their research accessible to all and save thousands of dollars in fees make their research accessible to all.

Our presence
We have some of the best designed publication formats. Our websites are very user friendly and enable you to do your work very easily with no hassle.

Something more...
We request you to have a look at our website to know more about us and our services.

We welcome you to interact with us, share with us, join us and of course publish with us.

CONNECT WITH US

Edorium Journals: On Web
Browse Journals

This page is not a part of the published article. This page is an introduction to Edorium Journals and the publication services.