



## Short communication

## A case of palytoxin poisoning due to contact with zoanthid corals through a skin injury

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## ABSTRACT

A case of human poisoning by palytoxin after contact with zoanthid corals (*Parazoanthus* sp.) in an aquarium through skin injuries on fingers is reported. The clinical symptoms include swelling, paraesthesia and numbness around the site of the injury spreading over the arm, but also signs of systemic poisoning such as dizziness, general weakness and myalgia, irregularities in the ECG and indications of rhabdomyolysis. Symptomatic treatment consisted of infusion of physiological fluids. The patient recovered within 3 days. Analysis of the zoanthid coral involved revealed extremely high concentrations of palytoxin (between 2 and 3 mg/g).

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## 1. Introduction

Colony-forming corals of the order Cnidaria, family: Zoanthidae, including species of *Palythoa*, *Protopalythoa*, *Zoanthus* and *Parazoanthus* are known to contain one of the most potent marine compounds, palytoxin (PTX), which has a complex polyketide structure (Moore and Scheuer, 1971; Moore, 1985; Shimizu, 1983; Gleibs et al., 1995; Gleibs and Mebs, 1999). The toxin has also been detected in a marine dinoflagellate, *Ostreopsis* sp. (Ukena et al., 2001). PTX has a LD<sub>50</sub> of 10–100 ng/kg (i.v. injection into mice; Wiles et al., 1974) and acts through the Na<sup>+</sup>/K<sup>+</sup>-ATPase of cell membranes where it induces the formation of pores resulting in the breakdown of the transmembrane potential (Habermann, 1989; Hilgemann, 2003; Artigas and Gadsby, 2003, 2004). The toxin is heat-stable and not inactivated by boiling. But despite the toxin's high lethal activity, several predatory worms, crustaceans and fish

feed on zoanthid corals without obvious harmful effects. Accumulation and sequestration of PTX in the marine food web has been documented (Gleibs and Mebs, 1999; Mebs, 1998), eventually causing human poisoning when eating seafood such as crustaceans and fish (Alcala et al., 1988; Kodama et al., 1989; Okano et al., 1998; Onuma et al., 1999; Taniyama et al., 2002; Yasumoto, 1999).

The colonies of various zoanthid species are popular decorations in sea water aquaria of zoos or of private enthusiasts. The animals easily propagate and their colonies quickly cover large parts of the aquarium. Intoxications with their toxin may occur during cleaning of the aquarium by inhaling a water aerosol where the toxin is dissolved. Here we report the first case of PTX poisoning following contact of zoanthid colonies with a skin injury.

## 2. Case report

A 32-year-old male was admitted to the surgical emergency department in the University Hospital of Heidelberg, Germany, 20 h after injuring three fingers of

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his right hand on a zoanthid colony while cleaning his sea water aquarium at home. The patient complained of shivering, myalgia and general weakness of all extremities with increasing intensity, which had started 2 h after the injury. About 16 h later, he had collapsed at his workplace exhibiting dizziness, speech disturbance and glassy eyes.

On admission three small (up to 5 mm) skin cuts at the tip of his first to third finger of the right hand with swelling and erythema were seen. He complained of paraesthesia and numbness of the fingers, which spread over the whole arm during the next 20 h. The patient was oriented with appropriate vigilance level; his coordination ability was not impaired. His pupils were isochor, but showed a delayed reaction to light. His speech was blurred. However, the brain nerve and deep tendon reflexes were appropriate. Cardiovascular examination revealed a rhythmic heartbeat without murmurs; blood pressure was within normal range (100/70 mm Hg) with a heart rate of 83. The ECG exhibited a sinus rhythm of a left type with an incomplete right bundle block (Fig. 1). Pulmonary examination presented no pathological findings; oxygen saturation was 100 per cent. Probably due to muscle cramps, the levels of creatine kinase (CK, 198 U/l), lactate dehydrogenase (LDH, 304 U/l) and of the C-reactive protein (CRP, 13.8 mg/l) were slightly elevated; all other blood parameters were within the normal range. Treatment consisted of infusion of physiological fluids.

Within the next 24 h the cardiac symptoms receded, but paraesthesia, weakness and muscle pain persisted until the patient was discharged 48 h later. At a follow-up examination 4 weeks after the accident, the patient reported no persisting complaints.

By inspection of the patient's aquarium, colonies of two zoanthid species he had obtained through the pet trade (origin of the specimens unknown) were identified as *Parazoanthus* sp. and *Palythoa* sp. Samples were taken and used for PTX assay.

### 3. Assay of PTX in the zoanthids

For the PTX assay, the samples were homogenized in distilled water, centrifuged at 900g and the toxin concentration was determined in the supernatant by delayed haemolysis of human red cells as described by Gleibs et al. (1995). Fifty microlitres of the extract or its various dilutions (with saline) were added to 1 ml of 0.5 per cent red cell suspension in saline containing 0.5 mM boric acid and 1 mM  $\text{CaCl}_2$ , and incubated for 4 h at 37 °C. After centrifugation the absorbency of the supernatant was measured at 405 nm. Total haemolysis was achieved by adding 50 µl of 1 per cent saponin solution to the red cell suspension. Activity is expressed in haemolytic units (HU); one unit (HU) is defined as the amount of material that produces 50 per cent haemolysis within 4 h of incubation. Ouabain is a specific inhibitor of PTX, due to its overlapping binding epitope on the  $\text{Na}^+/\text{K}^+$ -ATPase and thereby preventing channel formation by PTX (Scheiner-Bobis et al., 1994). In a control experiment, 0.1 mM ouabain was added to the red cell suspension and incubated at 37 °C for 30 min before the haemolysis test. Inhibition of haemolysis by ouabain indicated the presence of PTX.

Whereas the *Palythoa* sp. sample was entirely free of haemolytic activity, the sample of *Parazoanthus* sp. proved to be extremely active, exhibiting 7700 HU/g corresponding to about 2–3 mg toxin per g/wetweight.

### 4. Discussion

PTX poisoning may occur usually after consumption of toxin-contaminated sea food such as crustaceans and fish. To our knowledge, the present case represents the first intoxication due to permeation of the toxin through skin injuries after contact with the coral.

Toxin analysis of the two zoanthid species involved confirmed that one, e.g. *Parazoanthus* sp., contained an

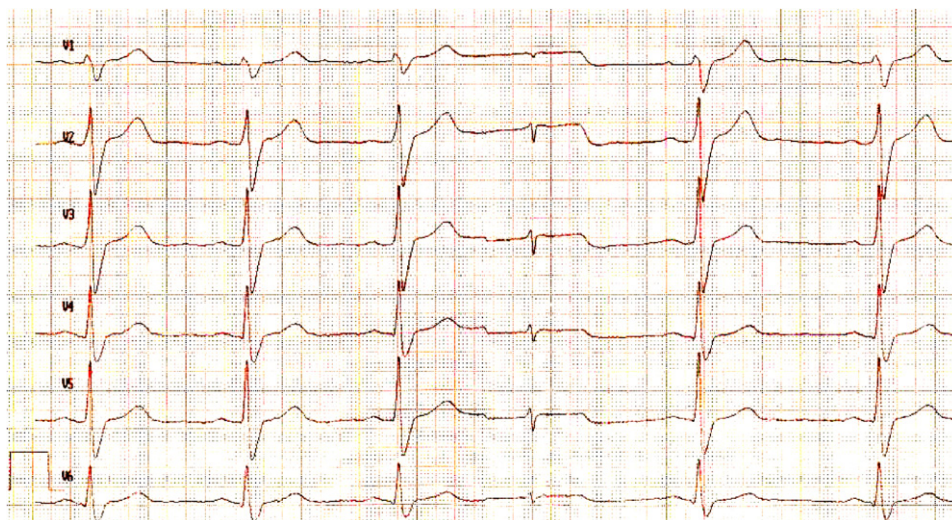


Fig. 1. ECG of the patient on admission showing right bundle block with broadened QRS complex in V1 and V2 as well as negative S wave in V6.

extremely high concentration of PTX, whereas *Palythoa* sp. produced no toxic effects in the in vitro assay. High variability in the PTX content has been demonstrated in zoanthid species from the Caribbean as well as Pacific Ocean (Gleibs et al., 1995; Gleibs and Mebs, 1999) ranging from nil to extremely high levels. While handling the corals without protection (no gloves), the patient was exposed to highly dangerous concentrations of the toxin, which eventually entered to body through the skin wounds causing general poisoning symptoms.

Beside local swelling, paraesthesia, myalgia and general weakness the patient exhibited particular cardiac symptoms, as seen in the electrocardiogram, suggesting that a myocardial injury induced by PTX may have occurred. These symptoms are similar to those observed after ingestion of toxin-contaminated fish such as raw meat of a blue humpback parrot fish as described by Okano et al. (1998). In that case myalgia, prostration, dyspnoea and dysphonia and severe rhabdomyolysis with consecutive renal failure occurred. Increased CK, LDH and CRP levels in the present patient may also be interpreted as signs of a mild rhabdomyolysis.

As suggested in the previous reports of PTX poisoning (Okano et al., 1998), treatment has to be symptomatic, because of the lack of an antidote. This includes massive hydration with physiological fluids to prevent renal failure. The patient has to be closely monitored in an intensive care unit to enable intervention when cardiac problems occur.

Staff of marine aquarium exhibits as well as people maintaining sea aquaria at home should be made aware of the potentially high risk when handling zoanthids. Since it is entirely unpredictable, whether the zoanthid specimens are toxic or not, protective devices such as thick rubber gloves and breathing masks should be used when in contact with the corals.

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