

PARALYTIC MUSSEL POISONING IN NATAL

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Paralytic mussel poisoning has been reported from many parts of the world.¹ Most of the literature refers to the Pacific Coast of North America, where extensive investigations have been conducted.² American workers³ have identified the neurotoxin as an alkaloid occurring in a dinoflagellate plankton, *Gonyaulax catenella*, on which the mussels feed. Sapeika⁴ first described its occurrence in South Africa and also isolated the alkaloid. A recent leading article⁵ noted that cases had not been reported for some time. We report here the poisoning of a Zulu family by mussels eaten on the coast of Natal, 35 miles north of Durban.

DESCRIPTION OF CASES

On the morning of 9 December 1957 a young Zulu mother of Tongaat collected mussels from rocks exposed by the low tide. She killed the mussels by heating them without added water, extracted them from their shells and washed them in rain water to remove sand. She then cooked them in a well-known vegetable oil, adding onion and curry powder for flavouring. In the evening, the mussels were eaten with dry maize porridge by herself, her husband, their 2 sons aged 8 and 3 years, and their daughter aged 5 years.

Onset of Symptoms

Less than 1 hour after the meal, the mother felt a peculiar lightness of her body, with a tingling around her mouth and in her fingers and toes. Unperturbed by these symptoms she went to bed with the rest of the family. About 6 hours after the meal she was awakened by her daughter calling out that she wanted to pass urine but could not move. The mother got up to find herself weak. In lighting the paraffin lamp her hand wavered. She said she had 'to pull herself together' before she could apply the match to the wick.

She managed to drag her daughter from the bed and had to support her whilst she passed urine. She then noticed that the child's breathing was laboured and that her attempts to speak resulted only in feeble inarticulate noises.

She awakened her husband and sent him to summon help. He did not feel ill but noticed that his body felt light and as he walked he had to concentrate hard to keep on the road. The mother also awakened both her sons and found that the eldest boy was hardly able to walk and his brother could neither sit up nor stand. She returned to her daughter, only to find her dead in bed.

Before leaving for hospital they noticed that a cat which had eaten the remnants of their meal was dragging itself about on its belly, owing to apparent loss of power in its lower front legs and hind legs.

Clinical Observations

Approximately 16 hours after the meal, the family was admitted to hospital. Both husband and wife complained of a feeling of lightness and tingling in their extremities and around their mouths. Clinical examination was, however, negative and both were symptom-free within 24 hours of eating the mussels.

The elder boy had a temperature of 99.8°F and weakness of the erector spinae muscles only. He had recovered completely 42 hours after eating the meal.

The younger boy's temperature was 100°F. He had a flaccid paresis of all four limbs and the erector spinae muscles were paralysed. The action of the intercostal muscles appeared weak. The deep reflexes were absent. He reacted normally to pinprick. The cerebrospinal fluid was normal. No treatment was given but a respirator was held in readiness. Within 24 hours he had improved. His temperature was normal and he could roll over in his cot and move all four limbs against gravity. However, it was not until the 5th day that he was able to sit up unaided. Weakness of the quadriceps femora was a marked feature, and to stand he had to climb up his legs like a child with pseudo hypertrophic myopathy. It was 14 days before he had recovered completely.

We saw the cat 4 days after it had eaten the mussels and it was then moving normally.

Investigation of the Mussels

The site of the poisoning was visited 4 days afterwards. There was no evidence of the red discolouration of the sea caused by the plankton floating on the surface which has been described by other workers,^{1, 2, 4} nor had this ever been noticed by the local inhabitants. Mussels were collected from the same rocks and submitted for examination to Mr. W. Pople, of the Zoology Department, University of Natal, to whom we are indebted for this report:

The mussels were the South African Black Mussel (*Mytilus meridionalis*). Attempts to recover a dinoflagellate from the crop contents and faeces were unsuccessful, but minute dinoflagellates were discovered in the rejection currents from the gills of all the mussels. These flagellates measured

3-4 μ , which is the same size as *Gonyaulax catenella*,⁶ but with the equipment available it was impossible to identify them exactly. Permanent slides were therefore made.

After the mussels had been in filtered sea water for 6 days, 6 were chosen for testing. By the method described by Dack⁷ two extracts were made from these mussels. One was made from the digestive glands and was brown in colour, the other, from the gills, was cream coloured. These extracts were tested by injecting them into the dorsal lymph spaces of 20-g. toads (*Bufo regularis*).

With the digestive gland extract it was found that 0.25 ml. caused paralysis of leg reflexes within 11 minutes and respiratory paralysis within 15 minutes. No effect was produced with 0.1 ml., while 0.5 ml. caused complete paralysis and death within 7 minutes. An injection of 0.5 ml. of the control gill extract produced no effect whatever.

Interpreting these results in accordance with Sapeika's statements⁸ that 10 times as much toxin is required to kill a frog as a mouse, and that 1 mouse unit is the quantity of toxin in 1 ml. of neutral solution required to kill a 20-g. mouse within 15 minutes, we can conclude that this extract has a toxicity well above 4,000 m.u. per 100 g. of mussel, which is considered significant by the American workers.²

DISCUSSION

It is 10 years since an outbreak of paralytic mussel poisoning occurred at Blaauwberg Strand, near Cape Town^{4, 9}. From the enquiries we have made, it appears not to have been experienced before in Natal, although mussels have always been a popular food.

Three other types of mussel poisoning have been described, namely, various allergic reactions, gastro-enteritis from eating mussels that are not fresh, and occasionally typhoid fever from mussels infected by sewage. However, death from these illnesses is uncommon. It is a significant fact that both now and in 1948, when paralytic poisoning has been encountered, deaths have occurred. The alkaloid which causes paralytic mussel poisoning accumulates in the digestive glands of the mussels, which are themselves unaffected by its presence. It is water-soluble and heat-stable in acid or neutral solution, but is rendered inert when boiled in an alkaline solution. Sapeika⁸ has shown that in addition to a central and neurotoxic action there is a depressant action on the myocardium and its conducting tissues.

The symptoms and signs in our cases are similar to those described previously. The cause of death is respiratory paralysis, and this probably occurred in the girl. The patho-

logy of this condition has not been adequately studied, and it is unfortunate that no autopsy was possible in our fatal case.

There is no known antidote to paralytic poisoning and accordingly the only measures which can be taken are preventive. There is no way of telling whether mussels contain the toxin, as it occurs in healthy fresh specimens. The only warning is the redness of the sea when the dinoflagellates abound. It is recommended therefore that all mussels for human consumption should be boiled in water containing bicarbonate of soda,⁴ in order to destroy the toxin which may be present. It should also be noted that since plankton floats on the surface, any other filter-feeding invertebrates such as sea-lice and rock oysters (*Ostrea cuculata*) which, like mussels, live between the tide levels, can accumulate this toxin.¹⁰

Symptoms occur soon after eating affected mussels and therefore an immediate stomach wash-out in suspected cases is imperative. Once paralysis is present the danger of respiratory failure has to be anticipated and the necessary apparatus for artificial respiration held ready. Pressor drugs such as ephedrine have been shown, experimentally, to combat myocardial depression.⁸

SUMMARY

An account is given of paralytic mussel poisoning in a Natal Zulul family, with the death of a child.

A dinoflagellate was recovered from the mussels, and from their digestive glands a potent neurotoxin was extracted.

The potential danger of eating fresh healthy mussels is stressed. This danger may be obviated by boiling them in a solution of sodium bicarbonate.

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