

SOUTH PACIFIC COMMISSIONSEMINAR ON ICHTHYOSARCOTOXISM

(Rangiroa, French Polynesia, 16th - 22nd August, 1968)

CIGUATERA IN THE RYUKYU AND AMAMI ISLANDS

by Yoshiro Hashimoto, Shoji Konosu and Takeshi Yasumoto*

Under the Japan-U.S. Cooperative Science Program, we commenced the present study on ciguatera in the Ryukyu and Amami Islands in 1966. At the start, we made a field survey to grasp the general situation of ciguatera and then a joint investigation using a questionnaire with the U.S. counterpart represented by Dr. Banner. In parallel with ciguatoxic fishes, other toxic marine animals were also investigated, but the following fish poisonings were excluded though we came across several cases; tetrodon poisoning, hypervitaminosis A due to the liver of large-sized fishes, scombroid fish poisoning, poisoning due to Vibrio parahaemolyticus, and diarrhea by castor oil fish.

In these investigations, the latent prevalence of ciguatera and outbreaks of turtle, crab and coconut crab poisonings were ascertained, as outlined in this paper.

Investigation methods

Information on ciguatera was gathered in 1966 and 1967 from organizations of both fisheries and public health. We also interviewed with many fishermen, fish dealers or inhabitants who had been poisoned. The investigation with a questionnaire was undertaken in 1966, by using "Questionnaire A" which has been widely adopted by the U.S. counterpart for years in the South Pacific. It was mainly distributed among the fishermen's associations selected by Department of Fisheries, Ryukyu Government.

In the field investigation, fish was identified by showing to reporters the plates in "Reports on the toxic fish in South Seas" edited by Dr. Y. Hiyama. In questionnaires, however, we encountered many ambiguous local names which could not be clearly defined.

Toxic species reported and their geographical distribution

Fishes reputed to be poisonous amounted to about 20 species. In the Ryukyu Islands, Lutjanus bohar was reported to be toxic in all places, and Gymnothorax flavimarginatus, L. monostigma, Variola louti, and Epinephelus fuscoguttatus in many places. These five species were considered to be the representative ciguatoxic fishes. Besides them, the following species were also reputed to be toxic in a few areas: L. vaigiensis, L. fulviflamma, Plectropomus truncatus, Aluterus scriptus, Sphyræna picuda, Lutjanus sp., Cheilinus sp., and Siganus sp.

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In the Amami Islands, the situations were slightly different; L. bohar was believed to be toxic universally, but V. louti and E. fuscoguttatus were said to be harmless except in Yoron Island. Neither ciguatera fish nor ciguatera was found at the southern extremity of Kyushu. The number and toxicity of ciguatera fishes seemed to decrease gradually in the northern areas from the Ryukyu Islands, and the Amami Islands were postulated to represent practically the northern limit of ciguatera fishes.

We received the report everywhere that some are poisonous but the other non-poisonous among fish of a given species caught simultaneously at the same fishing ground and that there is the narrow toxic area in which fishes are very dangerous as recognized well in the Central Pacific by the scientists in Hawaii University. All of the areas pointed out to be toxic were in a close connection with well-developed coral reefs.

General pattern of poisoning appeared in interviews

It was very easy to discover victims of poisoning and a total of 76 patients in 82 case histories were interviewed during a short field investigation. The record was prepared for the latest case when the reporter had been poisoned more than twice by the same fish, and separately for each case when poisoned by different species.

The poisoning from the ingestion of "Akana", L. bohar (33 cases), occupied approximately half of the cases both in the Ryukyu and Amami Islands. The second was E. fuscoguttatus (12 cases). Cases due to a moray eel, G. flavimarginatus, were rather few (8 cases), but included many patients. Most of the poisonings due to V. louti (7 cases) occurred more than ten years ago, except one case at Yoron Island. Only three poisoning cases due to L. monostigma were found, though it was considered to be much more poisonous than the other toxic species in the Ryukyu Islands. This may suggest that a belief on the high toxicity might have lessened the occurrence of poisoning. Besides these fishes, Plectropomus truncatus (one case), other sea basses (6 cases), and sharks (2 cases) were also reported to cause ciguatera.

Although inhabitants knew all the toxic fishes well, poisoning cases since 1961 amounted to as many as 21. The poisonings due to L. bohar and other species seemed to center in summer, especially from July to August. It may need a more close investigation to decide whether this phenomenon reflects the increase of toxicity in summer or merely the increase in the catch of fish.

A rabbitfish, Siganus sp. was reported to become toxic occasionally after the rainfall in June and in connection with the limited coral reefs.

Symptoms

In most of 82 cases investigated, the attack rate exceeded 50% and parts of fish eaten were chiefly flesh and head. The reported symptoms were diarrhea, vomiting, dry-ice sensation, joint-ache, fatigue, headache, and itching. Besides, abdominal pain, flush of the face or whole body, numbness of hands and limbs, and fever were reported occasionally. The poisoning was rarely fatal. In many kinds of fish, such as L. bohar, E. fuscoguttatus, G. flavimarginatus, V. louti, L. monostigma and others, the symptoms were similar and characterized by joint-ache, fatigue, and dry-ice sensation. Fishermen, especially diving fishermen in Okinawa complained that they were obliged to rest labour for several days to a few weeks because of tingling sensation of whole body in the sea. These symptoms coincided well with those reported on ciguatera in the Central and South Pacific. (J. E. Randall: Bull. Mar. Sci. Gulf. Caribb., 8(3), 236, 1958). A rabbitfish (Siganus sp.), on the other hand, caused the quite different symptoms such as headache and itching, suggesting the presence of a different toxin.

Legends for ciguatera

Many beliefs, mostly identical with those prevailing in the South Pacific (A.H. Banner et al.: South Pacific Com. Tech. Paper, No. 141, 1963) were reported for the cause of ciguatera, discrimination of toxic fish and native remedies.

Turtle, crab and coconut crab poisonings

Four cases of turtle poisoning, 19 of crab poisoning and 5 of coconut crab poisoning were located. The crab poisoning will be reported separately.

One of the turtle poisonings occurred in a research vessel of the Ryukyu Fisheries Research Laboratory at the Tosa Islands in the Republic of China and the others at the Yaeyama Islands. The symptoms were quite similar to those described previously in the Philippines (I.A. Ronquillo et al.: IPFC Tech. Papers, No. 47), and consisted of erosion in the mouth, chill, nausea, headache, itching, difficulty in swallowing and loss of hair. It took a long time for complete recovery and death occurred only in infants. In one case, a suckling was affected through the mother's milk.

The toxic turtle was believed by inhabitants to be a hybrid between the hawksbill turtle and another species. We obtained a photograph of the carapace of a turtle which affected about 80 persons including 6 infants who died, in 1954. On the basis of this photograph, Dr. J. Hendrickson, Sea Life Park of Hawaii, identified it as a hawksbill turtle, Eretmochelys imbricata imbricata Agassiz. It was said that around the Yaeyama Islands the toxic turtle was caught only occasionally, once every 4 or 5 years. When once caught, it may cause a mass-intoxication, as the turtle is large enough to intoxicate scores of people. As there were no poisoning cases in the other areas, the Yaeyama Islands seemed to lie on the northern limit of the distribution of toxic turtle.

Sporadic outbreaks of coconut crab poisoning and some legends on the origin of toxin were found, which have not yet been officially recorded. Although we did not collect more than 5 cases, it was felt very easy to collect many more cases in some areas. The symptoms were languor of the whole body, vomiting, and diarrhea, appearing within several hours after ingestion. Patients were usually in bed for several days from exhaustion. In our investigation, 4 out of a total of 19 patients died. Pigs seemed to be very sensitive to the toxin and to have been damaged considerably.

The coconut crab in question was called locally "Matsukon" or "Matsukan" and identified by Dr. S. Miyake as Birgus latro (Linnaeus) in the family Anomura. The toxicity of coconut crab was reported to show a narrow regionality and to relate to the presence of some plants, locally called "Fubogi", "Gana" or "Donattsu". "Fubogi" and "Gana" were found to be identical. They were identified as Diospyros maritima Blume Bijdr in the family Ebenacea and "Donattsu" as Hernandia sonora Linnaeus in the family Hernandiaceae respectively by Dr. S. Kurata. Coconut crabs were believed to become toxic when fed on the fruits of "Fubogi" or dwell under "Donattsu".

Discussion

The areas covered by the present survey were limited, and the number of poisoning cases will increase markedly if a more extensive investigation is extended to the uninvestigated areas.

Fishermen, fish dealers, and fish processors seemed to know fairly well about the toxic species or toxic areas and to have been taking adequate measures to eliminate or utilize toxic fishes on their own experiences. This must have contributed to diminishing outbreaks of poisoning to some extent. In Okinawa, some of the ciguatoxic fishes were used as materials for "Kamaboko" after the long freezing storage on the belief that toxicity decreases during storage. We also confirmed experimentally that ciguaterin disappears gradually during storage in the frozen state. The process involved in making "Kamaboko" to wash the minced meat thoroughly with water may be effective in removing the water-soluble toxin. The fat-soluble toxin, however, is kept unchanged during the freezing storage for months and may not be leached out by washing with water. Although the toxic flesh may be diluted considerably by non-toxic flesh in the process, this method still contains some risks.

Almost all of the patients had not received any medical treatment. This might have been connected with unavailability of medical aid, with high medical fees, or with a belief on low mortality and mildness of ciguatera. These circumstances might have brought about the indifference of authorities concerned to the latent poisonings due to toxic marine animals, as evidenced by the fact that we only discovered one official record on both the crab and turtle poisonings, and none on ciguatera. The authorities concerned should understand the actual condition of ciguatera and consider a counterplan as soon as possible.

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ABSTRACT

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In a field investigation, the latent prevalence of ciguatera in the Ryukyu and Amami Islands was ascertained and about 20 species of fish were reported to be toxic, excluding puffers, spoiled scombroid fishes, castor oil fishes and the liver of large-sized fishes such as tunas and sharks. Among them, the following five species were found to be most important as the cause of typical ciguatera, red snapper (Lutjanus bohar), snapper (L. monostigma), moray eels (Gymnothorax spp.), grouper (Epinephelus fuscoguttatus), and sea bass (Variola louti). Symptoms induced by these fishes were quite similar to each other and characterized by joint ache, languor, dry-ice sensation, diarrhea and vomiting. A narrow regionality of toxic fishes was reported, and it is interesting that the areas suspected to be toxic are closely related with well-developed coral reefs.

A rabbitfish (Signus sp.) was reported to induce occasionally itching, severe headache and flush of face, suggesting the presence of a different toxin. The following species were also reputed to be toxic in a few areas; L. vaigiensis, L. fulviflamma, Plectropomus truncatus, Aluterus scriptus, Pogonoperca punctata, Sphyræna picuda, Lutjanus sp., and Cheilinus sp.

Besides these fish poisonings, 4 cases due to toxic turtles, about 20 due to toxic crabs, and 5 due to coconut crabs were located respectively.

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