



Ciguatera management

by Richard J. Lewis¹

Ciguatera is a global disease caused by the consumption of warm-water fish contaminated with ciguatoxins—a family of heat-stable, lipid-soluble, highly oxygenated, cyclic polyether molecules. They have their origin in *Gymnodinium toxicus*, a benthic dinoflagellate (a type of single-celled algae) at the base of tropical nearshore marine food chains (Lewis & Holmes, 1993). Outbreaks of this algae, and thus of ciguatera, have complex environmental origins beyond the scope of this article.

Many species and many families of reef fish can be involved in ciguatera poisoning. Families include the muraenids (moray eels) and lutjanids (e.g. red snappers) which are notorious in the Pacific, serranids (groupers, coral trout, coral cod), lethrinids (emperors), scombrids (tuna-like fishes), carangids (jacks or trevallies) and sphyraenids (barracudas).

Ciguatera causes diverse and often long-lasting human health effects. While it is estimated to affect more than 25,000 persons annually (allowing for under reporting), fatalities are rare (~ 0.1% of cases). One exception is ciguatera in the Indian Ocean, which is more often fatal. Some fatalities may be avoided with the introduction of better clinical management practices, including the use of a mannitol therapy, discussed later.

While ciguatera is a global problem, it is mostly confined to discrete regions of the Pacific and western Indian Oceans, and the Caribbean Sea. In the Pacific, ciguatera has long been recognised as a widely distributed phenomenon affecting many of the island nations (Banner & Helfrich, 1964). Despite this wide distribution, there are many areas relatively free of ciguatera that are adjacent to areas of high risk. An explanation for such patchiness in the occurrence of ciguatera remains elusive. Current difficulties in predicting, detecting and treating ciguatera mean that this form of fish poisoning will continue to have large socio-economic impacts, particularly in third world countries. Nowhere are these impacts greater than in regions where fish is the principle source of protein, such as the atoll island communities of the Pacific (Lewis, 1992).

Symptoms and treatment

The symptoms of ciguatera (up to 30 or more) are well described in all regions where ciguatera is a significant problem. Bagnis *et al.* (1979) described over 3,000 cases of ciguatera in French Polynesia. A similar syndrome is observed in the western and central Pacific (Gillespie *et al.*, 1986). In the Pacific, the onset of the first symptoms can be as short as 30 minutes for severe intoxications, while in milder cases may be delayed for up to 24 or occasionally 48 hours from time of consumption of fish. The first symptoms are often neurological in nature (e.g. tingling of the lips). Some neurological symptoms can take several days to develop, including the reversal of temperature perception (see below), which is highly characteristic for ciguatera. Ciguatera typically lasts for several weeks, but sometimes lasts for months. In a small percentage of cases (estimated <5%) certain symptoms may persist, or may be induced, over a period extending into years. The severity, number and duration of symptoms reflect the combined influence of dose, toxin profile, and individual factors.

Gastrointestinal symptoms, such as vomiting, diarrhoea, nausea and abdominal pain, typically occur early in the course of the disease (> ~ 50% of cases), and often, but not always, accompany the neurological disturbances. Neurological disturbances that invariably occur in ciguatera include tingling of the lips, hands and feet, temperature perception disturbances where cold objects give a dry-ice sensation, and an intense itch that moves unpredictably across different patches of skin (> ~ 70% of cases). These symptoms can occur throughout the illness.

Generalised disturbances often include a profound feeling of fatigue (90% of cases) that can last throughout ciguatera. Aches of muscles (> 80%), joints (> 70%) and teeth (> 30%) occur to varying extents, and mood disorders including depression and anxiety (50%) occur less frequently. Severe cases of ciguatera can involve hypotension (abnormally low blood pressure) with bradycardia (reduced heartbeat), breathing difficulties and

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paralysis. Some sufferers of ciguatera experience adverse reactions to certain foods, and some victims experience a relapse of the symptoms initially experienced, while intoxicated with alcohol.

Differences in symptomatology of ciguatera between the Pacific Ocean, where neurological symptoms predominate, and the Caribbean Sea, where gastrointestinal symptoms predominate, have been shown to arise from different classes of ciguatoxins (Murata *et al.*, 1990; Lewis *et al.*, 1998). The similarity of ciguatera symptoms across the western, central and eastern Pacific, suggests that a class of similar ciguatoxins are involved. A third class of ciguatoxins (yet to be chemically defined) is likely to explain the different symptomatology observed in the Indian Ocean (Lewis & Hurbungs, unpubl.). Here fish can accumulate lethal levels of toxin (Habermehl *et al.*, 1994), and produce symptoms reminiscent of hallucinatory poisoning, including lack of coordination, loss of equilibrium, hallucinations, mental depression and nightmares (Quod & Turquet, 1996).

Effective treatment of ciguatera requires accurate diagnosis of the syndrome. Presently, ciguatera is a clinically determined disease, diagnosed based on an illness clustered around the recent consumption of a risk fish species. Intravenous mannitol was first introduced as a treatment for ciguatera in the late 1980s (Palafox *et al.*, 1988; Pearn *et al.*, 1989). Diagnosed cases of ciguatera where the patient is not dehydrated are treated with an intravenous infusion of mannitol, given at 1 g/kg over ~ 30 min. In instances where symptoms recur within the first 24 hours after treatment, a second infusion is usually effective. Mannitol is not consistently beneficial, but appears best when used in the acute phase of more severe intoxications. Reasons for a poor response are not known. Symptomatic and supportive therapies still have a role in managing more severe cases, especially for the control of fluid and electrolyte balance. Local anaesthetics and antidepressants may also be useful in some instances. During the recovery phase it is recommended that victims avoid fish and alcohol for 3–6 months, and long-term sufferers should consider whether avoidable foods are contributing to recurrences of symptoms.

Avoiding ciguateric fish

Presently there is no validated screen for ciguateric fish (Lewis, 1994 and 1995). Antibody assays and sodium channel assays are currently being developed that may provide a much-needed, cost-effective screen for ciguateric fish. Unfortunately, detection of ciguateric fish is made difficult by a number of factors, including the low levels of ciguatoxins

present in ciguateric fish (< 0.05 parts per billion for one common type of ciguatera molecule), the multiple structural forms that are present even within a single fish, the absence of any useful chromophore (a part of a molecule that is either coloured or absorbs light in the ultraviolet range making detection easier), the meagre quantities of ciguatera compounds available for research, and the difficulties of synthesising even fragments of these molecules.

Analytical methods with the required sensitivity have been developed, but are unlikely to be cost-effective for routine screening and require the streamlining of sample preparation (Lewis *et al.*, 1999). Tests that detect the presence of ciguatoxin in patients would overcome the present limitations of differential diagnosis.

Difficulties in detecting ciguatera are exacerbated when different classes of ciguatoxins are encountered as in Hong Kong where both Pacific and Indian Ocean ciguatoxins occur. In such instances sodium channel assays have some advantages because they reflect the potency of the toxins present without specific structural requirements. Alternative approaches to monitoring that can reduce the health risk associated with ciguateric fish include:

- Bans on the capture or trade of certain species;
- Bans on the capture or trade of fish from certain (high-risk) locations;
- Recommendations to consume small (<50 g) portions of any one fish;
- Bans on fish over a certain size (effectiveness not well documented).

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Grouper/Wrasse Species Survival Group formed

I am pleased to announce the formation of a new Specialist Group under the Species Survival Commission (SSC) of the International Union for the Conservation of Nature (IUCN) which specialises in groupers (Serranidae) and wrasses (Labridae). The IUCN SSC is a science-based network of experts located around the world whose mission it is 'to conserve biological diversity by developing and executing programmes to study, save, restore and manage wisely species and their habitats'.

Specialist groups carry out the main work of the SSC and are organised by species or group of species, by region, and/or by conservation theme or discipline across a wide range of plants and terrestrial and aquatic animals; their members are experts in their respective fields. They are invited and have, as part of their responsibility, to assess the conservation status of their particular species or group of animals. Assessments are carried out according to internationally accepted categories

and criteria established by IUCN. For those species determined to be under some level of threat, possible restorative action is identified with a view to maintaining biodiversity and healthy populations.

The grouper/wrasse group was formed in 1999 because of growing concerns over the status of several larger groupers and wrasses, which appear to be particularly vulnerable to overharvesting. Two species currently in the live reef fish trade are listed as 'Vulnerable' under IUCN criteria: these are the Humphead (Napoleon or Maori) wrasse, *Cheilinus undulatus*, and the Giant grouper, *Epinephelus lanceolatus*. About 16 other grouper species in commercial fisheries worldwide were also included in the 1996 IUCN Red List of Threatened Animals. For further information on this group, please contact me at: yjsadovy@hkusua.hku.hk

Yvonne Sadovy, Specialist Group Chair

