CIGUATERA FISH POISONING

GUIDE FOR HEALTH CARE PRACTITIONERS

MEDICAL CARE

To date, no vaccine nor specific treatments are available to treat CFP, therefore only symptomatic treatment is provided. In the absence of clinical studies with positively proven efficiency, the treatments mentioned below are purely informative.

DIGESTIVE DISORDERS

Antidiarrheal, antisecretory, antiemetic, antispasmodic drugs.

CARDIOVASCULAR DISORDERS

Atropine (IV or IM), cardiac analeptics in case of severe bradycardia and rehydration in case of severe hypotension.

NEUROLOGICAL AND MUSCULAR DISORDERS

Pain : **analgesic and nonsteroidal anti-inflammatory drugs.**

Pruritus (itching): **H1 anti-histaminic drugs**

Peripheral neuropathies and asthenia :

- **In acute phase**.
- Mannitol : in the case of nervous system impairment, perfusion of 0.5 to 1 g /kg of body weight over a period of 30-45 minutes, within 72 hours after the poisoning, for maximum effectiveness. ***Precautions: make sure the patient is properly rehydrated before mannitol administration.***
- **During the course of treatment:** multivitamin complex based on B vitamins (B1, B6, B12) and C.

Chronic forms: amitriptyline, fluoxetine, gabapentin, cholestyramine.

It is recommended to follow lifestyle and dietary advice during one month or as long as conditions are persisting.

BREAST-FEEDING WOMEN

Due to the risk of transmitting Ciguatoxins to the infant through breast milk, it is recommended to suspend breast-feeding for several weeks.

TRADITIONAL MEDICINE AND CIGUATERA

In the Pacific, a remedy based on leaves of Octopus bush tree (*Heliotropium foertherianum*) or "Tahinu/Tohonu" is often used by local populations to treat CFP. Five to ten yellow leaves are taken from the tree, rinsed, then dipped into 1 liter of water, boiled until it is reduced by half. The preparation can be taken hot or cold, in one or several intakes. In order to be effective, the decoction must be administered from the very first signs of the poisoning and never for more than three days in a row, according to the principles of the traditional Polynesian medicine.

Caution: the preparation must be used fresh and not for keeping. The concentrations of the active principle in *H. foertherianum* leaves may also vary from one island to another.

HYPERSENSITIVITY

Following CFP, the ingestion of certain types of food/beverages as well as specific circumstances (see below), may revive clinical manifestations such as itching, neurosensitive disturbances, muscle pain/weakness, intense tiredness, headache, sleep disorders, general malaise, *etc*.

The intensity and nature of these manifestations as well as the factors responsible for their aggravation and recurrence may vary from one individual to another.

This "hypersensitivity" condition may last for several weeks, months or even years, depending on the individuals, and proves particularly disabling.

The adoption of a specific elimination diet and the avoidance of certain behaviors/situations is essential and must be followed at least during the first month following the poisoning event or as long as the adverse reactions persist.

Keeping a diary will help patients to identify food, beverages and situations that must be avoided. This will also help survey how this "hypersentivity" condition changes over time.

A special attention should be paid to the following items, which are likely to revive clinical manifestations of the disease, and should be avoided in the event of a reaction.

This hypersensitive condition will eventually diminish and resolve over time.

FOOD, BEVERAGES AND BEHAVIORS TO AVOID FOLLOWING A POISONING

MARINE AND FRESH WATER PRODUCTS

- Lagoon, open-sea, fresh water fish, shellfish, seaweeds…
- Food supplements based on marine products (fish oil-based omega-3, spirulina …)
- Sauces and flavors based on marine products (oyster sauce, shrimp chips, …)

ANIMAL AND VEGETABLE PROTEINS

- Beef, pork meat, chicken, eggs, soya, *etc.*
- Animal or vegetable protein powder and even by-products may also be poorly tolerated.

BEVERAGES

- Alcohol
- Coffee and caffeine-based beverages, tea
- "Energy drinks".

MISCELLANEOUS

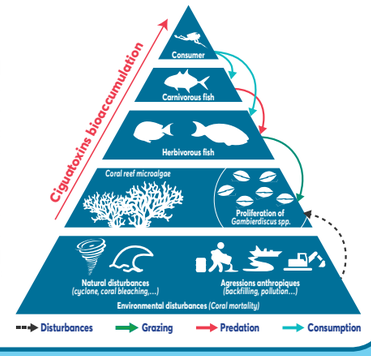
- Nuts (walnuts, peanuts…),
- Spices, high-fat food,
- Dairy products, chocolate, histamine-rich or -releasing products, glutamic acid.

BEHAVIORS AND SPECIFIC INSTANCES

Intense physical activity / effort, contact with cold water/objects, temperature variations, exposure to sun, altitude and pressure variations, stress.

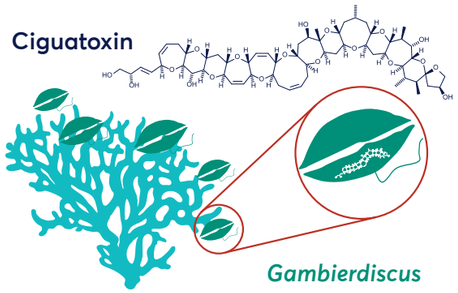
CIGUATERA FISH POISONING

Ciguatera is a non-infectious food-borne poisoning that results from the ingestion of fish and marine invertebrates (e.g. giant clams, sea urchins, trochus), living in lagoon/reef environments, that are unfit for human consumption due to the contamination by toxins. Although the first detailed accounts of poisoning events date back to the 15th Century (16th Century in French Polynesia), the exact origin of CFP was not known until the mid-1970s and points to a microalgae named *Gambierdiscus* (dinoflagellate), which grows preferentially within algal turfs covering degraded coral. The emergence of coral degradation/mortality zones (as a consequence of man-made and/or natural disturbances) requires increased vigilance as it is a potential starting point for ciguatera development. Ciguatoxic zones can be restricted to very localized surfaces or, in contrast, be very diffuse, and may vary at a temporal and spatial scale, making any follow-up of the phenomenon very complex.



TOXINS

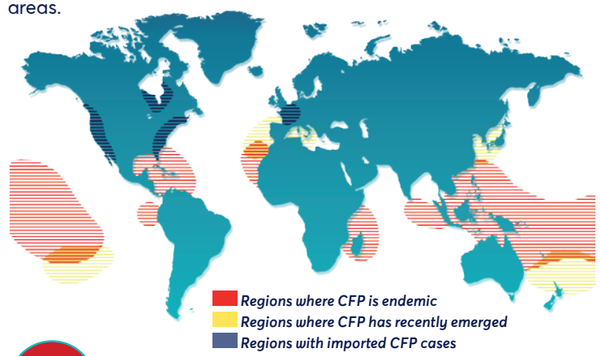
- *Gambierdiscus* is capable of producing several families of neurotoxins, including ciguatoxins (CTXs), responsible for human poisoning.
- CTXs are colorless and odorless poly-cyclical polyethers, resisting to cooking, freezing, smoking, *etc*.
- CTXs' main targets are voltage-gated sodium channels.
- Due to their lipophilic nature, CTXs are found in higher concentration in fish head and viscera.
- To date, over forty different CTXs congeners have been identified.
- The suite of CTXs present in contaminated fish may vary significantly from one species to another; a single species may host several different CTXs.
- CTXs are bioaccumulated and biotransformed along the food chain.
- This biotransformation process increases the toxicity of CTXs congeners



BIOGEOGRAPHY OF CIGUATERA FISH POISONING (CFP)

At a global scale, CFP is endemic in tropical and intertropical regions, with a predominance for lagoon and reef environments. However, CFP may also be observed in coastal waters devoid of coral reefs.

The Pacific Ocean (Cook Islands, French Polynesia, Marshall Islands, *etc.*) is by far the reservoir of choice for CFP. The number of CFP cases officially reported worldwide is estimated between 50,000 and 100,000 cases annually; however, these statistics likely represent only 10% of the actual cases, due to the high under-reporting of the disease. In the last decade, new CFP areas have emerged most notably as a consequence of climate change which may stimulate the geographical expansion and proliferation of the toxin-producing microalgae to previously unaffected areas.



In French Polynesia, CFP affects all island groups without distinction. At the scale of an island, areas such as passes surroundings and outer reef slope most likely to be exposed to natural or anthropogenic disturbances, as well as those with intense human activity (construction, quarrying, dredging, etc.) present an increased risk of ciguatera development.

IDENTIFICATION OF TOXIC SPECIES

Any fish exposed to blooms of the toxic microalgae, ***Gambierdiscus***, or having consumed a fish contaminated with ciguatoxins, must be regarded as potential ciguatera vector.

The **presence of ciguatoxins does not modify the appearance, odor or taste of the fish in any way.**

Folk detection tests (ants, flies, silver needle test, *etc.*) are not reliable to tell toxic fish from safe fish.

Trusting local residents and experienced fishermen is recommended as they generally have good knowledge of the risk species and fishing areas to avoid.

Toxic species vary from one country, group of islands, even from one island to another; however, some families show greater risk than others :

Snapper

Barracuda

Grouper

Surgeonfish

Moray eel

Parrotfish

Wrasse

Giant-clam

Emperor

Sea urchin

Jack and Pompano

Trochus

CFP DIAGNOSIS

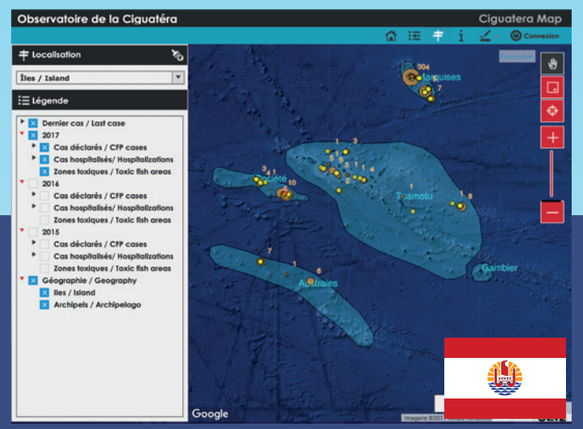
There is currently no biological test to confirm CFP diagnosis which relies solely on the anamnesis of the patient, through cross-checking of data related to the marine product consumed, and the nature and evolution of the clinical symptoms.

CLINICAL ELEMENTS INDICATIVE OF CIGUATERA

- Occurrence of the first **symptoms between 2 hrs and 48 hrs** following the consumption of lagoon fish/invertebrates. Digestive disorders are first to appear and generally do not persist for more than 72 hours.
- **In more severe forms:** concomitant occurrence of cardiovascular disorders (bradycardia, hypotension) that generally last for less than 72 hours.
- **Neurological disorders:** itching without cutaneous signs, neuro-sensitive disorders increasing with cold stimuli, extreme tiredness, general malaise, muscular disorders, transient hypothermia, *etc*.
- Development of a "hypersensitivity" condition (to some food, beverages and situations) which is responsible for transient reactivation/intensification of mostly neurological manifestations. Duration: from several weeks to several months and even years.
- The diagnosis is especially reinforced if manifestations occur in the context of a food-borne poisoning outbreak and/or if the marine product involved comes from a zone known to be affected by ciguatera.

EXCLUSION CRITERIA

- Allergic manifestations (rash, angioedema, *etc*.).
- Fever.
- Consumption of deep-sea/pelagic fish.



A catalog of the main fish species at risk of CFP in French Polynesia is also available online

IN FRENCH POLYNESIA…

EPIDEMIOLOGICAL MONITORING NETWORK AND I.T. TOOLS TO IDENTIFY SPECIES AND AREAS AT RISK OF CIGUATERA.

French Polynesia has implemented a CFP monitoring network that provides information about the CFP cases reported by physicians following medical consultations. The anonymous data thus collected are used to produce a CFP risk map available online (www.ciguatera-online.com), that allows the follow-up of the evolution of toxic fish species and areas.

CLINICAL MANIFESTATIONS

CFP, which is fatal in less than 0.1% of cases, is characterized by a wide variety of clinical signs (over 175 identified so far, based on the literature) generally grouped into four main families: digestive, cardiovascular, neurological/neuropsychiatric and general.

NEUROLOGICAL AND NEUROPSYCHIATRIC DISORDERS

- ▸ Paresthesia (tingling…)
- ▸ Cold allodynia
- ▸ Headaches, migraines
- ▸ Dizziness
- ▸ Muscle weakness
- ▸ Hypothermia, chills
- ▸ Sleep disorders
- ▸ Vision troubles (diplopia, ophtalmoplegia, photophobia)
- Ataxia
- Fainting, loss of consciousness
- Tremors
- Speech disorders
- Gait disturbances
- Prehension disturbances
- Respiratory disorders
- Difficulty concentrating
- Hallucinations
- Depression
- Motor deficit
- Cerebellar syndrome
- Reduced deep tendon reflexes
- Polyradiculoneuritis

DIGESTIVE DISORDERS

- ▸ Nausea
- ▸ Vomiting
- ▸ Diarrhea
- Stomach pain
- Constipation
- Painful defecation
- Hypersalivation
- Hiccup

CARDIOVASCULAR DISORDERS

- ▸ Hypotension
- ▸ Bradycardia
- Hypertension
- Tachycardia
- Heart rhythm disorders
- Chest pain
- T-wave abnormalities

GENERAL DISORDERS

- ▸ Itching, pruritus
- ▸ Urogenital burning/ itching
- ▸ Joint pain
- ▸ Oropharyngeal burning sensation
- ▸ Dysgeusia, metallic taste
- ▸ Myalgia
- ▸ Dental pain
- Painful ejaculation
- Dysuria
- Low back pains
- Memory disorders
- Excessive sweating
- Hair/nail loss
- Watery eyes
- Conjunctivitis
- Tinnitus

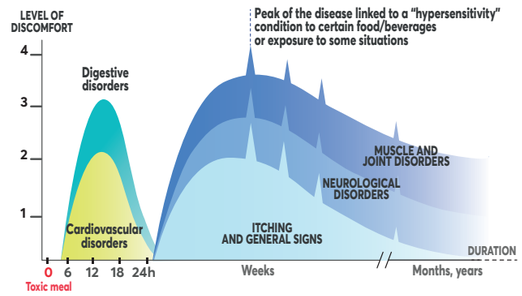
▸ ***Manifestations most frequently reported***

SEVERE FORMS AND AT RISK POPULATIONS

- ▸ Increased risk for the elderly.
- ▸ Persons with preexisting cardiopathy, hypotension.
- ▸ Pregnant women: rare descriptions of miscarriage and premature delivery cases resulting from poisoning during pregnancy, as well as presence of transient neurological disorders in infant if the poisoning occurs at the late stage of pregnancy.
- ▸ Diabetic populations: seem to have greater predisposition to chronic manifestations.
- ▸ Severe poisoning cases may result in polyradiculoneuritis, Guillain-Barré syndrome, cerebellar damage or death of the patient (rare case).

SYMPTOMS EVOLUTION AND CHRONIC MANIFESTATIONS

- **During the acute phase**, digestive and cardiovascular manifestations are generally first to appear, followed by neurological, muscular, joint and general disturbances.
- Chronic manifestations most frequently reported are itching, extremities and orofacial tingling, asthenia, painful/weak muscles, joint pain, general malaise, psychological tiredness, sleep disorders, memory and mood disorders, and even depression.
- Symptoms manifestations may be continuous and working silently and/or in the form of relapses lasting from a few days to a few weeks, generally triggered by the consumption of certain types of food/beverages, or exposure to specific situations (refer to FOOD, BEVERAGES AND BEHAVIORS TO AVOID FOLLOWING A POISONING).
- In most cases, the frequency and intensity of chronic manifestations eventually diminish and resolve over time.



Inspired from Lawrence et al 1980, JAMA 244 : 254-258

SYMPTOMATIC THRESHOLD

OR « THE STRAW THAT BROKE THE CAMEL'S BACK »

Individual impregnation by ciguatoxins may vary from one person to another, depending on one's dietary habits. As a result, in CFP endemic regions, the risk of chronic exposure to infratoxic doses of ciguatoxins, is significantly increased for frequent consumers of lagoon fish, comparatively to occasional consumers.

Ciguatoxins exert their effects through accumulation, *i.e.* poisoning signs appear only when the amount of toxins accumulated in the body reaches a threshold also known as "symptomatic threshold". Therefore, after ingesting the same toxic fish, it is likely that only one fraction of the guests will actually develop symptoms of the disease. Other factors, related to individual predisposition and susceptibility, also have an influence on symptoms triggering and the poisoning's degree of severity.

Level of toxins accumulated in the body
Individual symptomatic threshold