Food-Borne Infections Evade Common Defenses

When chicken was frozen for 1 week, about 10% of the Campylobacter jejuni *population still survived.*

BY TIMOTHY F. KIRN
Sacramento Bureau

INCLINE VILLAGE, NEV. — Freezing a food product does not always kill all the bacteria in it. Covering boiling water helps kill all the organisms in the pot. And houseflies can carry pathogenic *Escherichia coli*.

Those are some of the intriguing findings of recent studies in food-borne infectious disease, said Robert W. Derlet, M.D., at an annual emergency medicine meeting sponsored by the University of California, Davis.

U.S. Department of Agriculture researchers looked at whether refrigerating or freezing chicken at either 4° C or –20° C would kill *Campylobacter jejuni*, which is prevalent in U.S. poultry, said Dr. Derlet, who is chief of emergency medicine at the University of California, Davis.

The researchers found that when the chicken was frozen for 1 week, about 10% of the *C. jejuni* population survived, and when it was frozen for 2 weeks, 5% survived.

Obviously, most home refrigerators cannot achieve –20° C.

In addition, he said, "Other studies have shown that even with months of freezing, some bacteria that are hardy survive. *E. coli*, as well as salmonella, tend to be hardy environmental organisms."

An investigation of a large salmonellosis outbreak demonstrated that *Salmonella enterica* can be transferred from hands and grow rapidly in tomatoes.

The researchers concluded that freezing is not a substitute for proper cooking (Appl. Environ. Microbiol. 2004;70:7103-9).

Researchers from the Centers for Disease Control and Prevention, who are studying *Bacillus anthracis* because of its potential use as a bioterrorism agent, investigated whether boiling water contaminated with the organisms would sterilize the water.

They found that when the water was covered and then boiled for either 3 minutes or 5 minutes, all the organisms were killed.

However, when the water was boiled uncovered, high numbers of the organisms survived (Emerg. Infect. Dis. 2004;10:1887-8).

Some organisms can encapsulate into spores and survive intense temperatures, Dr. Derlet said. Clostridia, for example, form temperature-resistant capsules that break down when they cool, which is why there are instances of people becoming sick after eating soup that has cooled.

Researchers at Kansas State University collected flies from a cattle farm in that state to see if the insects could be contributing to dissemination of *E. coli* O157:H7, which may be present in up to 40% of beef that comes from a feedlot or passes through a stockyard.

They found that 6% of the flies collected harbored the organism, which can cause hemolytic–uremic syndrome (Appl. Environ. Microbiol. 2004;70:7578-80).

Flies can also carry shigella, salmonella, and cholera, and a fly needs only a second to get its mouth parts onto your food—though it is not known if in that time the fly can deposit enough organisms to make someone ill.

An investigation of an outbreak of perhaps 3,000 cases of salmonellosis contracted from raw tomatoes served at a fast-food restaurant chain in 1999 demonstrated that *Salmonella enterica* can be transferred from hands and grow rapidly in tomatoes, Dr. Derlet noted.

A recent study has now shown that *S. enterica* can survive on vegetables for 200 days, at least under experimental conditions (Appl. Environ. Microbiol. 2004;70:2497-502). ■

It's Summertime: Be on the Lookout for Seafood Poisoning

BY MICHELE G. SULLIVAN
Mid-Atlantic Bureau

MIAMI BEACH — Seaside visitors are at risk for deadly vacation mementos: neurotoxic poisoning from contaminated seafood.

"The reality of the world is that someone can be in the Caribbean one day and in an emergency room in Minnesota with ciguatera the next," Elijah W. Stommel, M.D., said at the annual meeting of the American Academy of Neurology. "We all need to be prepared to deal with these illnesses."

Most of the world's vacation hot spots boast their own unique seafood toxins, said Dr. Stommel, a neurologist at Dartmouth-Hitchcock Medical Center, Lebanon, N.H.

Caribbean reef fish carry ciguatera, and shellfish from picturesque islands of eastern Canada can pack an algal toxin wallop.

Scombroid poisoning can be found wherever fresh tuna and other game fish are consumed.

A trip to Japan (or an expensive sushi bar) can increase the risk of puffer fish poisoning, which kills about 80 people a year in Japan.

Even the quiet coasts of New England can be dangerous for shellfish lovers; saxitoxin—which occurs in contaminated oysters, clams, and scallops—is 1,000 times more potent than sarin.

Ciguatera is the most common nonbacterial seafood poisoning. "This is a very interesting toxin, and it's commonly seen in emergency and neurology departments all over the world," Dr. Stommel said. The toxin originates in a dinoflagellate that lives in bottom algae in tropical areas. Bottom feeders—barracudas, snappers, jacks, and groupers—ingest the algae with their meal, and the toxin concentrates in flesh as it moves up the food chain to humans.

Ciguatera opens the sodium channels, thereby changing the cells' electrical potential and permeability and increasing neuronal excitability. The toxin also affects coagulation, can alter acetylcholine receptors, and has serotoninergic effects.

Initial symptoms are gastrointestinal pain, nausea, vomiting, and diarrhea. Other symptoms follow, including dysesthesias of the extremities, itching (especially after drinking alcohol), headaches, vertigo, circumoral tingling, muscle pain, and fasciculations. "Patients may also complain of a sense that their teeth are loose," Dr. Stommel said.

Inverted sensory perception is another classic symptom. "Patients walking on cold tile will complain of burning feet. This is considered by some to be pathognomonic of marine toxin poisoning."

Ciguatera is probably underdiagnosed, because the diagnosis must be made solely on the basis of symptoms and history. There is no known antidote, so treatment must be supportive. High doses of intravenous mannitol (1 g/kg of a 20% solution) have been used for years for symptom relief, but a 2002 report suggests that saline infusion is just as effective. Atropine can be useful for bradycardia. In serious cases, calcium gluconate, which acts as a substrate against competitive inhibition of calcium by the ciguatoxin, is recommended.

Even the quiet coasts of New England can be dangerous for shellfish lovers—saxitoxin is 1,000 times more potent than sarin.

Most patients recover in 3-6 weeks, but symptoms can recur when patients consume chicken (chicken feed contains fish meal) or alcohol. A serotonin-sparing diet is important during the acute phase and for 3-6 months afterward. This diet includes eliminating fish and shellfish, nuts, coconuts, seeds, seed products (including oils), alcohol, mayonnaise, chocolate, and mushrooms.

Amnestic shellfish poisoning has been reported in southern Canada, California, Washington, Oregon, and coastal Europe. An algae-dwelling diatom produces the toxin domoic acid, a glutamate agonist. This toxin can cause extensive hippocampal damage, as well as less severe damage to the thalamus and forebrain.

Within 24 hours of eating contaminated shellfish, patients will have GI symptoms followed by memory loss, seizures, hemiparesis, ophthalmoplegia, and coma. Poisoned patients may grimace and make chewing motions. Blood pressure lability may develop along with cardiac dysrhythmias.

There is no antidote. Benzodiazepines or glutamate antagonists such as valproic or kynurenic acid may suppress the excitotoxic effects. The disease can be fatal, and memory loss can be permanent.

Paralytic shellfish poisoning causes severe, almost immediate symptoms, including tingling, numbness, vertigo, dysarthria, dysphagia, weakness, ataxia, and even blindness. There are no GI symptoms. The lack of diarrhea and vomiting may contribute to the high rate of mortality because more of the toxin is absorbed rather than expelled from the body. Death is usually the result of respiratory failure.

The cause is saxitoxin, produced by several microorganisms and 1,000 times more potent than sarin gas. Saxitoxin blocks sodium channels in nerve and muscle, which arrests impulse conduction and can suppress atrioventricular node conduction.

There is no antidote; treatment is supportive. The toxin binds well to charcoal. Acidity enhances the toxin's effects, so serum alkalinization might be helpful.

Tetrodotoxin occurs in the organs of the puffer fish (*Fugu rubripes*), a delicacy in Japan, where fugu poisoning affects about 150 people yearly with 50% mortality. Symptoms develop within 20 minutes to 3 hours of consumption, and include oral and extremity paresthesias, GI disturbance, hypersalivation, diaphoresis, cranial nerve dysfunction, refractory hypotension, and cardiovascular collapse. Partial or complete paralysis may occur, although the patient can remain lucid. Death usually occurs within 4-6 hours.

"Again, there is no known antidote," Dr. Stommel said. Gastric lavage and activated charcoal can be useful early in the course of the poisoning. Anticholinesterase agents, atropine, and α-agonists have been effective for cardiovascular instabilities.

Scombroid, the world's most common seafood poisoning, results from toxins that build up in improperly stored fish. It's most common in members of the tuna family but can occur in other game fish. Scombroid isn't fatal; the symptoms of headache, nausea, vomiting, diarrhea, abdominal cramps, and burning of the mouth and oropharynx usually subside within 12 hours.

Treatment usually consists of charcoal and histamine blockers (cimetidine or famotidine). It's advisable to block both H_1 and H_2 receptors. ■

Pages 22a—22b