Possible Origin of *Clostridium botulinum* Contamination of Eskimo Foods in Northwestern Alaska

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Soils from beaches in northwestern Alaska have been found to contain *Clostridium botulinum* type E, providing evidence of one environmental source of food contamination.

Alaska has the highest rate of morbidity from type E botulism in man in the United States (8). More than one-half of the outbreaks in Alaska have occurred in the northwestern region, and in all but one outbreak the foods implicated have been prepared solely from marine mammals (3). Insanitary conditions, a cultural preference for uncooked foods of marine origin, and the presence of type E *Clostridium botulinum* spores in the surroundings have been considered to be prerequisites for endemic type E botulism (5). In Alaska, the first two conditions have been met, whereas the third has been suggested by the number of cases of botulism that has occurred.

Although the organism has been isolated from, or detected in, fish (9) and crabs (7) taken from Alaskan waters and foods implicated in cases of botulism (3), a source within the physical environment has not been demonstrated. Dubovsky and Meyer (6) were unable to confirm its presence in a soil sample found in south central Alaska. Studies of the marine sediments from the Bering and Chuckchi Seas did not show the presence of *C. botulinum* (5). Consequently, a search for alternate nidi of the organism was indicated. Isolations from beach shorelines are not uncommon, having been reported from Lake Michigan (1) and Hokkaido, Japan (10); therefore, beaches near recent outbreaks or beaches used in the production of the implicated foods were sought. One set of nine soil samples was collected at Kotzebue, Alaska, and one set of four samples was collected at Point Hope, Alaska, coastal communities where the most recent outbreaks had occurred. An additional set of 10 samples was collected on the beach at Elephant Point, Alaska, an important locality for harvesting beluga (*Delphinapterus leucas* Pallas). Flippers of these whales had been implicated in four outbreaks. With the exception of those from Point Hope, all of the samples were collected at mean tideline.

The soil samples were collected aseptically in screw-cap vials and refrigerated until cultured 12 to 14 months later. Five grams of soil was transferred into 120 ml of freshly prepared TPGY (Trypticase, 5%; peptone, 0.5%; glucose, 0.4%; yeast extract, 2%; sodium thioglycolate, 0.1%) and incubated for as long as 7 days in loosely stoppered water dilution bottles under anaerobic conditions at 28 C. Cultures were examined for the presence of toxin at 4 and 7 days. Toxin detection and typing by intraperitoneal injection of supernatant fluids into mice and the identification of isolates were performed by the procedures of the Center for Disease Control (11). The Center supplied the antitoxins used for typing.

Of the 23 samples, 17 produced type E toxin in culture, and the organism was isolated from at least one culture from each locality (Table 1).

At the time the samples were collected, marine mammals were being butchered on the beaches at Kotzebue and at Elephant Point; the animals had been killed at sea and towed to the beach for further processing. The skinning and butchering of animals on such beaches provide ample opportunity for contact of the meat and blubber with soils that might contain *C. botulinum*.

Our results do not rule out other means by which the food might have become contaminated. The animals themselves could harbor the organism, providing an endogenous source of contamination for both the foods and beaches. Earlier investigations into sources of botulinum contamination have been reviewed.

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Table 1. Occurrence of Clostridium botulinum in soil samples from Alaskan beaches

| Beach            | No. of samples studied | No. positive for toxin | No. of C. botulinum isolates | Serum neutralization | Type E | Other* |
|------------------|------------------------|------------------------|------------------------------|----------------------|--------|--------|
| Elephant Point    | 10                     | 6                      | 4                            |                       | 6      | 0      |
| Kotzebue Point    | 9                      | 9                      | 4                            |                       | 9      | 0      |
| Point Hope        | 4                      | 2                      | 1                            |                       | 2      | 0      |

* Refers to types A, B, C, D, and F.

by Dolman and Chang (4). Recent studies of botulinum contamination of soils along the shores of Lake Balkhash in the Kazakh SSR suggest that one source of type E contamination of soils may be fish entrails (2). Despite the unsuccessful attempts by Dolman and Iida (5) to isolate the organism in sediments off Alaskan coasts, the role of sediments near the shore as a reservoir of C. botulinum remains unknown. Our results do, however, identify beach soils as one source of the C. botulinum in foods prepared by Eskimos in northwestern Alaska.

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