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CHAPTER 19

Botulism as an Intestinal Toxemia

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Traditionally, botulism has been known as a foodborne disease and as such has always been of interest to gastroenterologists. Eighteen years ago the traditional view of botulism was revised and expanded following the recognition of a new form of the disease, i.e., infant botulism. Infant botulism is an infection of the intestinal tract in which ingested *Clostridium botulinum* spores germinate, multiply, and temporarily colonize the lumen of the large intestine and produce botulinum toxin in it. A minute fraction of the intraluminal toxin is then absorbed and carried by the bloodstream to peripheral cholinergic synapses, where it binds irreversibly. Clinically, the neuromuscular junction is the most important peripheral cholinergic synapse, and its poisoning by botulinum toxin results in hypotonia and flaccid paralysis. Botulinum neurotoxin is the most poisonous substance known. Its seven serologically distinguishable forms have arbitrarily been given the letters A–G. These seven toxin types serve as convenient clinical and epidemiological markers.

Recognition of infant botulism led to the discovery of two novel clostridial species that can make botulinum-like neurotoxins and colonize the human colon. Discovery of these additional neurotoxigenic clostridia necessitated a better descriptive term for the infectious form of botulism, now referred to as "the intestinal toxemias of infancy" or "intestinal toxemia botulism." The distinction from diseases caused by other toxin-producing intestinal bacteria (e.g., *Shigella dysenteriae* type 1, *Escherichia coli, Vibrio cholerae*) is that the intestinal toxemia clostridia neither invade the mucosa (like *Shigella* or some *E. coli*) nor produce a mucosally active toxin (like *V. cholerae* or other *E. coli*). Under exceptional circumstances (e.g., changes in normal anatomy and gut flora), adults can become ill with "infant-type" botulism. Intestinal toxemia botulism in infants and adults is the subject of this chapter.

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HISTORY

Reliable descriptions of foodborne botulism date to nineteenth century Germany, where Kerner described an illness known locally as "sausage poisoning." In 1895 in the small Belgian town of Ellezelles, an outbreak occurred among 34 musicians who had eaten from a raw ham preserved in salt brine. Twenty-three persons became sick, 13 severely, and 3 died. This episode of botulism became famous because Emile van Ermengem (1851–1922), Professor of Microbiology at the University of Ghent, carried out a now classical investigation that established the essential aspects of botulism. van Ermengem discovered the obligatorily anaerobic, spore-forming bacterium known today as *Clostridium botulinum* and its phenomenally potent heat-labile toxin, which caused a wide variety of vertebrate animals to die from flaccid muscle paralysis. Much subsequent work in the United States on the ecology of the bacterium and the eradication of its spores from canned foods was carried out in the early decades of the twentieth century by Meyer, Dack, and colleagues (1).

The second form of human botulism to be recognized, wound botulism, was first reported in 1951 (1). Wound botulism is an infectious disease and is the pathophysiological equivalent of tetanus. Wound botulism remains the rarest form of human botulism, with somewhat over 100 cases reported worldwide. An occasional case of wound botulism has occurred as a complication of intestinal surgery (2). Wound botulism was the subject of a recent review (3) and will not be discussed further here.

Infant botulism, the third form of human botulism, was recognized as a distinct clinical and epidemiological entity in 1976 (4,5), more than 50 years after Orr had first demonstrated the possibility experimentally (6). Shortly after modern recognition of the first cases and the naming of the entity, the novel pathogenesis of infant botulism was demonstrated (7,8). Discovery in the late 1970s of a laboratory-proven case of infant botulism that occurred in 1931, yet was misdiagnosed at the time, helped confirm that infant botulism was not a "new" disease but only a