Binding of Clostridium botulinum neurotoxin to gangliosides

Abstract:

The binding characteristics of Clostridium botulinum neurotoxins of types B, C1, and F to gangliosides was studied by thin layer chromatography plate and microtiter plate methods at low (10 mM NaCl in 10 mM Tris-HCl buffer, pH 7.2) or high (150 mM NaCl in 10 mM Tris-HCl buffer, pH 7.2) ionic strengths and at 0 or 37 degrees C. The three types of toxins bound exclusively to three kinds of gangliosides, GD1a, GD1b, and GT1b, in both the thin layer chromatography plate and the microtiter plate methods. Type C1 toxin bound to the three gangliosides under all the conditions, while type B and F toxins bound only at low ionic strength and 37 degrees C. At low ionic strength, the binding kinetics for the three toxins was monophasic in Scatchard plots, and the association constants obtained in the microtiter plate system were 2-4 X 10(8) M-1. In contrast, the binding kinetics of type C1 toxin in high ionic strength was biphasic in the Scatchard plot, and two association constants were obtained in the microtiter plate system. The heavy chain facilitated the binding of the toxin to the gangliosides. These results indicate that different types of botulinum toxins bind to the gangliosides under different optimal conditions and that gangliosides may not be the common receptor for all types of botulinum toxins. The gangliosides may bind to type C1 toxin together with other potential receptor(s) on synaptosomal membranes.