Distinct Sets of Anti-Glycolipid Antibodies Are Associated with Latent Factors in Guillain-Barré Syndrome by Exploratory Factor Analysis

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Guillain-Barré syndrome (GBS) is an acute immune-mediated neuropathy of the peripheral nervous system (PNS), where anti-glycolipid antibodies are often associated with some clinical signs. Although molecular mimicry between microbes and PNS antigens may explain the generation of some anti-glycolipid antibodies, the precise cause(s) and/or the total number and nature of autoantigens leading to the autoantibody responses are unclear. Exploratory factor analysis (EFA) has been developed as a powerful statistical procedure in psychological research to identify the nature and number of latent constructs (= factors) underlying a set of observed variables. Thus, in the biomedical field, EFA is ideal for identifying the latent factors or causes of diseases. However, EFA has been rarely used in biomedical research. We hypothesized that a restricted number of latent factors, such as different autoantigens, could induce distinct sets of anti-glycolipid antibodies in GBS. Combinatorial glycoarray allowed us to quantify serum antibody titers against 10 glycolipids and 45 combinations of two different glycolipids. With an R package “psych”, we conducted EFA of antibody data from 100 samples, using a parallel analysis for factor number determination, a maximum-likelihood method for factor extraction, and a geomin rotation for factor rotation. We were able to extract five factors, consisting of a distinct set of antibodies whose factor loadings were greater than 0.5; factor loadings are regression coefficients between antibody titers and factors. The target antigens of antibodies in each factor are localized in specific structures of the PNS as follows. Factor 1: LM1, galactocerebroside, and asialo-GM1 (mostly myelin antigens). Factor 2: GQ1b, GM2, GD1a, and their complexes (GQ1b: paranodal myelin antigens of cranial nerves III, IV, and VI). Factor 3: GM1 and its complexes (axonal membrane antigens). Factor 4: GD1b complexes (peripheral nerve paranodal myelin and dorsal root ganglion cell antigens). Factor 5: GalNAc-GD1a and its complexes (paranodal axonal membrane antigens). This is the first study to determine the clusters of autoantigens associated with GBS by EFA and give insight into the potential factors that induce a distinct set of antibodies that can be associated with the destruction of specific PNS components.