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Research Article

B-Lymphocytes from a Population of Children with Autism Spectrum Disorder and Their Unaffected Siblings Exhibit Hypersensitivity to Thimerosal

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The role of thimerosal containing vaccines in the development of autism spectrum disorder (ASD) has been an area of intense debate, as has the presence of mercury dental amalgams and fish ingestion by pregnant mothers. We studied the effects of thimerosal on cell proliferation and mitochondrial function from B-lymphocytes taken from individuals with autism, their nonautistic twins, and their nontwin siblings. Eleven families were examined and compared to matched controls. B-cells were grown with increasing levels of thimerosal, and various assays (LDH, XTT, DCFH, etc.) were performed to examine the effects on cellular proliferation and mitochondrial function. A subpopulation of eight individuals (4 ASD, 2 twins, and 2 siblings) from four of the families showed thimerosal hypersensitivity, whereas none of the control individuals displayed this response. The thimerosal concentration required to inhibit cell proliferation in these individuals was only 40% of controls. Cells hypersensitive to thimerosal also had higher levels of oxidative stress markers, protein carbonyls, and oxidant generation. This suggests certain individuals with a mild mitochondrial defect may be highly susceptible to mitochondrial specific toxins like the vaccine preservative thimerosal.

1. Introduction

Autism spectrum disorder (ASD) is a complex developmental disorder characterized by abnormalities of verbal and nonverbal communication, stereotyped restricted interests, repetitive behavioral patterns, and impairment of socialization. ASD now affects 1 in 88 children in the USA [1, 2]. In Great Britain, the costs of supporting children with ASD amount to be £2.7 bil/yr, while for adults these costs amount to £25 bil/year [3]. Recent studies have estimated that the lifetime cost to care for an individual with an ASD is $3.2 mil [4]. In the USA individuals with ASD have medical expenditures 4.1–6.2x greater than those without ASD, with median expenditures being almost 9 times greater [5, 6]. ASD is usually diagnosed before 4 years of age and has a 5 : 1 male to female gender bias. Although it is believed that multiple interacting genetic and environmental factors influence individual vulnerability to ASD, none have been reproducibly identified in more than a fraction of cases. In addition to complex gene-environment interactions, the heterogeneous presentation of behavioral symptoms within the spectrum of autistic disorders suggests a variable and multifactorial pathogenesis.

Mercury. Mercury is a ubiquitous environmental contaminant, that is, transformed into the volatile neurotoxins methylmercury and ethylmercury. In the United States, more than 8500 water bodies in 45 states and territories are listed as impaired for Hg in water, sediments, and/or fish tissue, including many sites lacking a point source of Hg pollution [7]. In addition to the environmental inorganic/organic mercury assaults many children have been exposed to ethylmercury in the form of thimerosal (called thiomersal in the UK, marketed as Merthiolate in the USA) has been used as a preservative agent for vaccines and toxoids [8]. The relationship between thimerosal and ASD has become a very debated topic over the last decade and some researchers have