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ETIO PATHOGENESIS OF AUTOIMMUNITY

Aluminum in the central nervous system (CNS): toxicity in humans and animals, vaccine adjuvants, and autoimmunity

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Abstract We have examined the neurotoxicity of aluminum in humans and animals under various conditions, following different routes of administration, and provide an overview of the various associated disease states. The literature demonstrates clearly negative impacts of aluminum on the nervous system across the age span. In adults, aluminum exposure can lead to apparently age-related neurological deficits resembling Alzheimer's and has been linked to this disease and to the Guamanian variant, ALS–PDC. Similar outcomes have been found in animal models. In addition, injection of aluminum adjuvants in an attempt to model Gulf War syndrome and associated neurological deficits leads to an ALS phenotype in young male mice. In young children, a highly significant correlation exists between the number of pediatric aluminum-adjuvanted vaccines administered and the rate of autism spectrum disorders. Many of the features of aluminum-induced neurotoxicity may arise, in part, from autoimmune reactions, as part of the ASIA syndrome.

Keywords Autism · ALS · Alzheimer's · Neurodegeneration · Immune response

Introduction

We live in what one leading researcher on the chemistry of aluminum has called "the Aluminum Age" [1]. Aluminum, the third most abundant element in the Earth's crust and the most abundant metal, is one of the most remarkable elements in the periodic table. Objects made with aluminum are strong, durable, light and corrosion resistant. Aluminum is an excellent conductor of electricity. For these reasons, aluminum currently finds its way into virtually every aspect of our daily lives. Aluminum is used in cans and cookware, aluminum foil, housing materials, components of electrical devices, airplanes, boats, cars and numerous hardware items of all descriptions [2].

With aluminum geologically bound up in various molecular complexes, it is only in the last century that has become available for human use and, importantly, become bioavailable [2, 3]. In terms of bioavailability, aluminum is now found in drinking water due to its action as a flocculant, is a common additive in various processed foods, is added to cosmetics of many types, and, increasingly, shows up pharmaceutical products (Table 1). Notably, in regard to the latter, various aluminum salts are used as vaccine adjuvants. As a result of all of this, aluminum in the human environment is increasingly found in our bodies (Fig. 1) [4–7].

Aluminum is extremely reactive with carbon and oxygen, two of the leading elements of life on Earth. For this reason, the widespread use of bioavailable aluminum may have immense and far reaching implications for the health of humans and animals. In fact, much evidence shows that

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