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Autism: A form of lead and mercury toxicity

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ABSTRACT

Aim: Autism is a developmental disability characterized by severe deficits in social interaction and communication. The definite cause of autism is still unknown. The aim of this study is to find out the relation between exposure to Lead and/or mercury as heavy metals and autistic symptoms, dealing with the heavy metals with chelating agents can improve the autististic symptoms.

Method: Blood and hair samples were obtained from 45 children from Upper Egypt with autism between the ages of 2 and 10 years and 45 children served as controls in the same age range, after taken an informed consent and fill a questionnaire to assess the risk factors. The samples were analyzed blindly for lead and mercury by using atomic absorption and ICP-MS. Data from the two groups were compared, then follow up of the autistic children after treatment with chelating agents were done.

Results: The results obtained showed significant difference among the two groups, there was high level of mercury and lead among those kids with autism. Significant decline in the blood level of lead and mercury with the use of DMSA as a chelating agent. In addition, there was decline in the autistic symptoms with the decrease in the lead and mercury level in blood.

Conclusion: Lead and mercury considered as one of the main causes of autism. Environmental exposure as well as defect in heavy metal metabolism is responsible for the high level of heavy metals. Detoxification by chelating agents had great role in improvement of those kids.

1. Introduction

Autistic disorder (ASD) is a neurodevelopmental syndrome with onset before the age of 36 months. Diagnostic criteria consist of impairments in sociality and communication plus repetitive and stereotypic behaviors (Bernard et al., 2001; Blaurock-Busch et al., 2011).

The reported prevalence of ASD has increased in recent decades. Information from the Centers for Disease Control and Prevention (CDC) and National Health Interview Survey (NHIS) revealed a nearly fourfold increase in parent-reported ASD between the 1997–1999 and 2006–2008 surveillance periods. CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network revealed a 78% increase in ASD prevalence between 2002 and 2008 in USA (Boyle et al., 2011; CDC, 2012). Approximately one in 54 boys and one in 252 girls living in the ADDM Network communities were identified as having ASDs. Also, as a comparison of 2008 findings with those for earlier surveillance years revealed an increase in estimated ASD prevalence of 23% when the 2008 data were compared with the data for 2006. These data confirm that the estimated prevalence of ASDs identified in the ADDM network surveillance populations continues to increase. The extent to

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which these increases reflect better case ascertainment as a result of increases in awareness and access to services or true increases in prevalence of ASD symptoms. ASDs continue to be an important public health concern in the United States. Under scoring of these symptoms indicate the need for continued resources to identify potential risk factors and to provide essential supports for persons with ASDs and their families (CDC, 2012; Blumberg et al., 2013).

According to the US Census Bureau, International Database (2004) in the USA the extrapolated prevalence is 587,310 autistic persons in 293,655,405-estimated population, while in Egypt 152,234 extrapolated prevalence in estimated population 76,117,421 that is considered by the US Census Bureau as a warning estimation. Although autism occurs in all cultures and countries, most of the published research came from Western countries, little known about its clinical correlates and co-morbidity in Middle Eastern and Arab countries (Al-Salehi and Ghaziuddin, 2009; Hussein et al., 2011) and although autism is not classified as degenerative disorders, life expectancy in these groups is somewhat reduced compared to the general population (Tyler et al., 2007; Levy and Perry, 2011).

The cause of autism remains vague, it is considered a mutifactorial disorder that influenced by genetic, environmental, and immunological factors as well as increased vulnerability to oxidative stress. No single gene has been found to be associated with autism, and involvement of multiple genes has been postulated (Keller and Persico, 2003; Sung et al., 2005). Environmental agents, such as mercury, lead, measles, rubella virus, retinoic acid, maternal thalidomide, valproic acid and alcohol use during gestation have been evoked to be implied in the etiology of autism (London, 2000; Mutter et al., 2005).

Some possible sources of heavy metal poisoning include chemical products, fertilizers, industrial paint, building materials, fish that is high in mercury, silver dental fillings, mercury-containing preservatives (thiomersal) in vaccines, nasal sprays, and many more. Lead may be found in the dirt near roads, leaded gasoline and can still be found in the paint from older houses. Children eating paint chips or those with pica may develop toxic lead levels (Blaurock-Busch et al., 2011). Most children get lead poisoning from living or staying in older homes that have lead paint. Many homes built before 1978 have lead paint on the inside and outside of the building. When old paint cracks and peels, it makes lead dust. Children get lead poisoning from swallowing dust on their hands and toys, also can get lead poisoning from the plumbing (CDC, 2013).

In autistic children, the problem usually appears to, not due to high exposure, but rather decreased excretion. The half-life of lead, mercury, and other toxic metals in the blood is weeks to months, so those metals rapidly leave the blood and accumulate in tissue and/or bone (Adams et al., 2013). Heavy metals considered as reproductive and developmental toxins, they could cause birth defect and fetal developmental damage, neurological defects, developmental delay, learning disabilities and behavioral abnormalities (Blaurock-Busch et al., 2011).

This paper hypothesized that exposure to variable environmental risk factors may affect tissue concentration of lead and/or mercury, thus contributing to the genesis of autistic spectrum disorder. This vulnerability may be either prenatal, postnatal, or in cumulative pattern. the study proposed to test some potential environmental risk factors and sources of exposure to lead and/or quicksilver, as they are the most usual types of heavy metals that can cause neural defects in children with autism spectrum disorder versus controls. Level of lead and/or mercury were measured in blood and hair samples in both autistic and control groups, in the promise of building connections between environmental exposures to heavy metals and appearence of autistic spectrum disorder. In summation, This paper hypothesized that decrease exposure and treatment of these heavy metals toxicity with chelating agents may improve the symptoms of the autistic children and hence improve their quality of life and learning ability.

2. Subjects and Methods

Forty-five autistic spectrum disorder (ASD) children (32 boys and 13 girls) between the age of 3 and 10 years were diagnosed as autistic spectrum by pediatricians and psychologist; they were diagnosed by using the DSM-5 criteria according to Carpenter (2013). This criteria includes: (A) Persistent deficits in social communication and social interaction across contexts, not accounted for by general development delays, and manifest by 3 of 3 symptoms. (B) Restricted, repetitive patterns of behavior, interests, or activities as manifested by at least 2 of 4 symptoms. (C) Symptoms must be present in early childhood (but may not become fully manifest until social demands exceed limited capacities). (D) Symptoms together limit and impair everyday functioning.

All children attended special care in center for these cases in Assiut city, Egypt. This work was performed in the period from January 2012 to January 2014. This research follows all ethical considerations of human research according to Kapp (2006), All ethical rules for the Assiut Univesrity, Faculty of Medicine were followed, informed consent from parents, consent from the special care center, confidentiality of the results were saved.

Blood and hair samples were collected after taking informed consent from their parents and filled a structured questionnaire which is used to collect the following information about (age – gender – parents education – parents occupation – age of the mother during pregnancy – type of delivery and if there was any complications during pregnancy or not – presence of other cases in the family – environmental exposure to any toxin during pregnancy – type of feeding of the mother during pregnancy – environmental exposure to any toxin for the father – cigarette smoking or shisha smoking – child symptoms – symptoms related to vaccination – and pica) (Boseila et al., 2004).

A control group was selected, which included 45 age-matched and sex-matched children without any psychiatric, medical disorders or developmental delay. These children were from the pediatric department diagnosed as normal children without any autistic disorders.

Exclusion criteria include: refusal to participate, physically handicapped children and children with progressive neurological disorders and unstable epilepsy. We excluded children who were taking regular medications including stimulants, anticonvulsants, atypical antipsychotic drugs,