Are mercury and Alzheimer's disease linked?

Paolo D. Pigatto a, Antonella Costa b, Gianpaolo Guzzi c,⁎

a Department of Biomedical, Surgical and Dental Sciences, Dermatologic Clinic, IRCCS Galeazzi Hospital, University of Milan, Milan, Italy
b Department of Neuroradiology, IRCCS Ca’ Granda Foundation, Maggiore Hospital Policlinico, University of Milan, Milan, Italy
c Italian Association for Metals and Biocompatibility Research – A.I.R.M.E.B., Milan, Italy

HIGHLIGHTS

• Mercury seems to be a risk factor for Alzheimer’s disease.
• Analysis suggests a link between mercury and neurotoxicity microtubule-associated.
• Elevated blood mercury levels in patients with Alzheimer’s disease

ARTICLE INFO

Article history:
Received 24 July 2017
Received in revised form 4 September 2017
Accepted 4 September 2017
Available online 8 September 2017

Editor: D. Barcelo

Keywords:
Agnosia
Anemia
Aphasia
Apraxia
Brain toxicity
Deficits cognitive function
Dementia
Environmental exposure
Environmental neurotoxicant
Human
Mercury exposure
Mercury emission
Neurotoxicity microtubule-associated
Neurotoxicity
Progressive degenerative brain disease

To the Editor:

In his Commentary [2017], Dr. Chakraborty stresses the potential hazards of low-level long-term exposure to mercury and the increase of prevalence of Alzheimer’s disease in the general population of India, a view we wholeheartedly endorse. We applaud the tenor of the piece (Chakraborty, 2017) and we have some additional points to make as well.

We share the concern expressed by Dr. Chakraborty (2017) through his excellent Commentary, since a previous clinical study estimated that there was a two-to-threefold increase of mercury levels in blood of patients with Alzheimer’s disease, as compared to control patients (Hock et al., 1998).

Researchers have also hypothesized that exposure to mercury may, in part, explain the hippocampal zinc loss in brain tissue from patients with Alzheimer’s disease (Constantinidis, 1991). The postulated mechanism is the molecular mimicry (Corrigan et al., 1993). In fact,
nonessential metal toxicants act primarily and additively through molecular ionic mimicry, replacement of essential metals, and competition for metabolism in biological systems (Constantinidis, 1991; Corrigan et al., 1993). It has been demonstrated that there is a mercury deposition in human brain regions (i.e.; hippocampus and amygdala), which are involved in memory and other cognitive functions, suggesting that mercury may have a possible role in Alzheimer’s disease pathophysiology (Wenstrup et al., 1990).

Mercury is neurotoxic in vitro and the effects reported of this neurotoxicant on mature neurons as well as adult neuronal stem cells have been assessed (Cedrola et al., 2003). Others have suggested that such neurodegenerative conditions as Alzheimer’s disease are associated with the accumulation of mercury - which causes oxidative stress - in the brain of pre-exposed animals, involving delayed neurotoxic effects (Monnet-Tschudi et al., 2006). Research in a rat model has shown that neuronal beta-tubulin defects may be induced by inorganic mercury (Duhr et al., 1993; Pendergrass et al., 1997), with a suspected connection between exposure to this metal and Alzheimer’s disease.

Accordingly, there are sufficient data to conclude that mercury may interfere with assembly of microtubules from tubulin in the nervous system. There is a possible association between brain tissue levels of mercury and Alzheimer’s disease. Finally, there is initial evidence of elevated levels of blood mercury in individuals with Alzheimer’s disease. An extrapolation of such results suggests that mercury seems to be a risk factor for Alzheimer’s disease. These studies have enormous implications for Alzheimer’s disease and therefore deserve future investigation.

References


