

Research Article

Mercury Disposition in Suckling Rats: Comparative Assessment Following Parenteral Exposure to Thiomersal and Mercuric Chloride

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Due to the facts that thiomersal-containing vaccine is still in use in many developing countries, and all forms of mercury have recognised neurotoxic, nephrotoxic, and other toxic effects, studies on disposition of ethylmercury and other mercury forms are still justified, especially at young age. Our investigation aimed at comparing mercury distribution and rate of excretion in the early period of life following exposure to either thiomersal (TM) or mercuric chloride (HgCl_2) in suckling rats. Three experimental groups were studied: control, TM, and HgCl_2 , with 12 to 18 pups in each. Both forms of mercury were administered subcutaneously in equimolar quantities ($0.81 \mu\text{mol/kg b.w.}$) three times during the suckling period (on the days of birth 7, 9, and 11) to mimic the vaccination regimen in infants. After the last administration of TM or HgCl_2 , total mercury retention and excretion was assessed during following six days. In TM-exposed group mercury retention was higher in the brain, enteral excretion was similar, and urinary excretion was much lower compared to HgCl_2 -exposed sucklings. More research is still needed to elucidate all aspects of toxicokinetics and most harmful neurotoxic potential of various forms of mercury, especially in the earliest period of life.

1. Introduction

Mercury is a pervasive environmental contaminant with proven toxic properties in mammals. Major risks recognized due to mercury exposure are dietary methylmercury exposure from fish and seafood, elemental mercury vapour from amalgam in tooth “silver fillings,” and thiomersal-contained ethylmercury in vaccines [1–3]. Thiomersal (thimerosal, merthiolate) has been banned in the United States and Canada since 1999 and in the European Union since 2001 from vaccines recommended for children below seven years [4–6].

The molecule of thiomersal is sodium ethylmercury-thiosalicylate that dissociates to ethylmercury and thiosalicylate [7]. Ethylmercury is acting as a preservative against bacterial and fungal contamination of the vaccines that are repeatedly given to infants (Diphtheria-Tetanus-acellular-Pertussis vaccine, 3 to 7 times) up to 6 months of age. A potential threat of neurodevelopmental toxic effect of

mercury lies in the fact that the exposure occurs in the most vulnerable period of life, when the brain is developing and growing [8]. Organic forms of mercury are more easily absorbed when ingested and are less readily eliminated from the body than its inorganic forms [1].

By now considerable amount of evidence has been collected to prove that doses of thiomersal in human vaccines do not pose harm, except for the risk of local hypersensitivity reactions [9–19]. In a recent overview Dórea [20] integrated experimental neurotoxicity studies of low-dose thiomersal in vaccines and concluded that doses relevant to thiomersal-containing vaccines exposure possess the potential to affect human neurodevelopment. A recently published experimental study in thiomersal-exposed infant rats reopens the debate on thiomersal-induced neurotoxic threat showing perturbations in the balance between excitatory and inhibitory amino acids in the brain, shifting it towards excessive neuroexcitation that may lead to neurodevelopmental disorders [21].