Effect of thimerosal, a preservative in vaccines, on intracellular Ca\(^{2+}\) concentration of rat cerebellar neurons

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Received 13 June 2003; received in revised form 1 September 2003; accepted 1 September 2003

Abstract

The effect of thimerosal, an organomercurial preservative in vaccines, on cerebellar neurons dissociated from 2-week-old rats was compared with those of methylmercury using a flow cytometer with appropriate fluorescent dyes. Thimerosal and methylmercury at concentrations ranging from 0.3 to 10 \(\mu\)M increased the intracellular concentration of Ca\(^{2+}\) (\([\text{Ca}^{2+}]_i\)) in a concentration-dependent manner. The potency of 10 \(\mu\)M thimerosal to increase the \([\text{Ca}^{2+}]_i\) was less than that of 10 \(\mu\)M methylmercury. Their effects on the \([\text{Ca}^{2+}]_i\) were greatly attenuated, but not completely suppressed, under external Ca\(^{2+}\)-free condition, suggesting a possibility that both agents increase membrane Ca\(^{2+}\) permeability and release Ca\(^{2+}\) from intracellular calcium stores. The effect of 10 \(\mu\)M thimerosal was not affected by simultaneous application of 30 \(\mu\)M L-cysteine whereas that of 10 \(\mu\)M methylmercury was significantly suppressed. The potency of thimerosal was similar to that of methylmercury in the presence of L-cysteine. Both agents at 1 \(\mu\)M or more similarly decreased the cellular content of glutathione in a concentration-dependent manner, suggesting an increase in oxidative stress. Results indicate that thimerosal exerts some cytotoxic actions on cerebellar granule neurons dissociated from 2-week-old rats and its potency is almost similar to that of methylmercury.

Keywords: Thimerosal; Vaccine; Preservative; Cerebellar neurons; Calcium

1. Introduction

Thimerosal is an organomercurial preservative in vaccines to prevent contamination with harmful microbes and its derivative is ethylmercury. There is a concern on the part of public health community that adverse health consequences by thimerosal may occur among infants during immunization schedule although it is generally believed that the safety of thimerosal use for humans have been established (Mahaffey, 1999; Ball et al., 2001).