Effect of Highly Toxic Coplanar PCB on Peroxisomal Enzyme Activity : The Species Difference between Rats and Guinea Pigs

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Introduction

We have demonstrated that a highly toxic coplanar PCB congener, 3,4,5,3',4'-pentachlorobiphenyl (PenCB), which is contaminated in commercial PCB mixture,¹⁾ induces markedly bilirubin UDP-glucuronyltransferase and CYP4A1 in the liver of guinea pigs, but suppresses them in rats.²⁾ It is also known that lipid metabolism of Yusho patients is disordered. Peroxisomes play an important role in lipid metabolism, and their proliferation is regulated concomitantly with induction of microsomal CYP4A in rat liver.³⁾ In this study, we investigated the effect of PenCB on peroxisomal enzyme activities in rats and guinea pigs in order to clarify the relevancy in regulation of peroxisomal enzymes and CYP4A1, and propose a possibility of toxic effect by changing of peroxisomal enzyme activities.

Methods

Male Hartley guinea pigs and Wistar rats were treated with PenCB as described previously.²⁾ A pair-fed control group was provided in addition to a free-fed control group to determine the effect by reduced amount of food intake in the PenCB-treated group. Animals were sacrificed and 10% (w/v) homogenate of liver was prepared to determine peroxisomal enzyme activities.

Results and Discussion

Three enzyme activities localized in peroxisomes were measured and compared in both animal species. Cyanide-insensitive fatty acid

CoA oxidation system activity in PenCB-treated guinea pigs was slightly increased, but was markedly decreased (55%) in PenCB-treated rats. Urate oxidase activity was induced notably in guinea pigs, however, that in rats was reduced by PenCB-treatment. Catalase activity in PenCB-treated guinea pigs was at a similar level to the free-fed control group, but the activity was somewhat higher than the pair-fed control group. By contrast, the activity in PenCB-treated rats was remarkably reduced to about 40% of the pair-fed control group. These changes were consistent with that of CYP4A1 expression and activity in both animal species. In order to determine the mechanism of the marked loss of catalase in rats by the treatment with PenCB, immunoblot analysis was performed with anti-catalase antibody. This suppressed expression of catalase protein in the liver of PenCB-treated rats to about 40% of pair-fed control rats. The present study suggests that peroxisomal enzymes can be affected by coplanar PCB, and that the alteration of enzyme expression may be involved in the toxicity. These changes may also correlate with lipid metabolism by CYP4A in both rats and guinea pigs.

References

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