ELSEVIER

Biochimica et Biophysica Acta 1474 (2000) 397–409

BIOCHIMICA ET BIOPHYSICA ACTA
BBA

www.elsevier.com/locate/bba

Presence and inducibility of peroxisomes in a human glioblastoma cell line

A. Cimini [a], L. Cristiano [a], A. Bernardo [b], S. Farioli-Vecchioli [a], S. Stefanini [c], M.P. Cerù [a,*]

[a] *Department of Basic and Applied Biology, University of L'Aquila, via Vetoio n. 10, 67010 Coppito (AQ), Italy*
[b] *Istituto Superiore di Sanità, Rome, Italy*
[c] *Department of Cellular and Developmental Biology, University of Rome 'La Sapienza', Rome, Italy*

Received 3 August 1999; received in revised form 22 February 2000; accepted 29 February 2000

Abstract

We investigated the effect of the peroxisomal proliferator (PP) perfluorodecanoic acid (PFDA), alone or in combination with 9-*cis*-retinoic acid (RX) on the human glioblastoma cell line Lipari (LI). Cell proliferation, apoptotic rate, peroxisome morphology and morphometry, peroxisomal enzyme activities and the presence of peroxisome proliferator-activated receptors (PPARs) were examined. We show that PFDA alone produces pleiotropic effects on LI cells and that RX enhances some of these effects. Peroxisomal number and relative volume, as well as palmitoyl-CoA oxidase activity and protein, are increased by PFDA treatment, with a synergistic effect by RX. The latter, alone or in association with PFDA, induces catalase activity and protein, increases apoptosis and decreases cell proliferation. PPAR isotypes α and γ were detected in LI cells. While the former is apparently unaffected by either treatment, the latter increases in response to PFDA, independent of the presence of RX. The results of this study are discussed in terms of PPARα activation and PPARγ induction by PFDA, by either a direct or an indirect mechanism.

Keywords: Peroxisome proliferator; Peroxisome proliferator-activated receptor; Neuroectodermal cell line; Catalase cytochemistry; Apoptosis; Perfluorodecanoic acid

1. Introduction

Peroxisomes are involved in several important metabolic pathways, particularly those related to lipid metabolism, such as the biosynthesis of ether glycerolipids, cholesterol and bile acids and the catabolism of very long chain fatty acids, polyunsaturated fatty acids and eicosanoids [1,2].

Although the specific roles played by peroxisomes in the central nervous system (CNS) are still obscure, their importance is stressed by the severe neurological damages observed in a group of inherited metabolic diseases, named peroxisomal disorders, which are characterised by abnormalities in morphological features and/or enzymatic content of these organelles [3]. Biochemical [4–7] and morphological [8–13] studies on neural peroxisomes showed their high heterogeneity, which most probably reflects multiple functions related to the various nervous cell types. While an important role played by oligodendrocyte peroxisomes in myelinogenesis is generally recognised, other putative functions of peroxisomes in neural cells are yet poorly clarified. Characterisation of peroxisomes in nervous tissue has mostly been performed in the rat, while few data on human CNS peroxisomes are to date available [14–17].

Lipari (LI) is a human glioblastoma cell line, first established and described by Zupi et al. [18]. These cells have been demonstrated to respond to all-*trans*-retinoic acid (RA) with a low degree of glial differentiation, involving the expression of cell adhesion molecules and the possible secretion of neuropeptides [19]. Among human neuroectodermal cell lines, LI exhibits the highest basal level of catalase activity, which increases after RA treatment [20]. Therefore, we choose LI cells as a model to study the presence of peroxisomes, their morphological and biochemical features and their inducibility.

In this regard, it should be remembered that rodent liver peroxisomes are induced by a class of substances, collectively named peroxisomal proliferators (PPs) [21]. Specifi-

* Corresponding author. Fax: +39-862-433-273; E-mail: ceru@aquila.infn.it

0304-4165/00/$ – see front matter
PII: S0304-4165(00)00036-2