Nanodelivery of cerebrolysin and rearing in enriched environment induce neuroprotective effects in a preclinical rat model of Parkinson?s disease

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Rearing in enriched environment (EE) improves the recuperation in animal models of Parkinson?s disease (PD). Administration of TiO2-nanowired cerebrolysin (CBL) could represent an additional strategy to protect or repair the nigrostriatal system. This study aims to explore morphofunctional and biochemical changes in a preclinical stage of PD testing the synergistic efficiency of combining both strategies, housing in EE, and nanodelivery of CBL. Sprague-Dawley male rats receiving intrastriatally 6- hydroxydopamine after a short evolution time were segregated into CBL group (rats receiving nanowired CBL), EE group (rats housed in EE), CBL + EE group (rats housed in EE and receiving nanowired CBL), and control group (rats without additional treatment). Prodromic stage and treatment effects were characterized by the presence of motor symptoms (amphetamine-induced rotational behavior test). Tyrosine hydroxylase (TH) immunohistochemistry and Western blot (p-Akt/ Akt and p-ERK/ERK 1/2 as survival markers and caspase-3 as apoptotic marker) were performed in striatum and SN. A decrease in motor symptoms was shown by rats receiving CBL. EE monitoring cages revealed that rats from CBL + EE group showed more significant number of laps in the wheel than EE group. In SN, CBL + EE group also presented the highest neuronal density.

Moreover, p-Akt/Akt and p-ERK/ERK 1/2 ratio was significant higher and caspase-3 expression was lower in CBL + EE group. In conclusion, the combination of CBL and EE provided evidence of neuoprotectiveneurorestorative mechanisms by which this combined strategy promoted morphofunctional improvement by activation of survival pathways after dopamine depletion in a preclinical model of PD.

6-OHDA

Enriched environment

Nanowired cerebrolysin

Neuroprotection

Parkinson?s disease

Preclinical stage

caspase 3

cerebrolysin

mitogen activated protein kinase

mitogen activated protein kinase 1

mitogen activated protein kinase 3

nanowire

protein kinase B

tyrosine 3 monooxygenase

amino acid

cerebrolysin

nanoparticle

neuroprotective agent

Akt signaling

animal experiment

animal model

animal tissue

Article

caudate nucleus

controlled study

corpus striatum

drug effect

environmental enrichment

male

MAPK signaling

motor dysfunction

nerve cell network

neuroprotection

nonhuman

Parkinson disease

protein expression

putamen

rat

rearing

substantia nigra

therapy effect

animal

disease model

drug delivery system

environment

metabolism

parkinsonism

pathology

procedures

Sprague Dawley rat

Amino Acids

Animals

Disease Models, Animal

Drug Delivery Systems

Environment

Male

Nanoparticles

Neuroprotective Agents

Parkinsonian Disorders

Rats

Rats, Sprague-Dawley