Effects of oxidative stress and inflammation induced by ultrafine particles on Alzheimer disease onset

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Alzheimer's disease (AD) is a neurodegenerative illness affecting the elderly population, characterized by plaques of Aβ42 aggregates, neurofibrillary tangles and neuronal loss (Allsop, 2000). Several epidemiologic studies propose that air pollution may exert adverse effects on central nervous system (CNS) functions and that these effects are chronic, as they begin during childhood and may take time to result in a pathological outcome. Ultrafine particles (UFPs), which seems to be able to reach the brain, cause the greatest health effects (Block and Calderón-Garcidueñas, 2009). Inflammation and oxidative stress have been suggested as underlying mechanisms by which PM exerts its harmful action on CNS (Genc et al., 2012). Therefore, the aim of this work was to evaluate the activation of oxidative stress and inflammation in mice exposed to UFPs and to elucidate putative physiopathological correlations with neurodegeneration.

Male BALB/c mice were submitted to single or repeated intratracheal instillation with UFPs from two different anthropogenic sources: BC (pellet boiler biomass emission) and DEP (EURO 4 diesel engine emission) (50μg); in parallel, control mice were always considered (sham). Cortex, cerebellum and hippocampus from sham and treated mice were screened for markers of inflammation and oxidative stress (iNOS, HO-1), endoplasmic reticulum stress (Hsp70), a putative pro-carcinogenic marker (Cyp1B1) and markers related to the onset of AD (P-Tau, Tau, P-APP, APP, BACE1).

The single DEP and BC instillation induced oxidative stress, endoplasmic reticulum stress and inflammation, while typical AD-related proteins seemed not affected. The repeated instillation was able to sustain oxidative stress and inflammation; moreover, it induced increase of BACE1 levels and changes in APP total levels and phosphorylation. Finally, BC seemed to be less effective than DEP.

In conclusion, our results suggest UFPs or inflammatory mediators translocation from lungs, and their effects on the brain, after both acute and repeated DEP and BC treatment.

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