BMC Proceedings

Poster presentation

Alzheimer's disease – a neurospirochetosis

Judith Miklossy

Address: Kinsmen Laboratory of Neurological Research, The University of British Columbia, Vancouver, B.C., V6T 1Z3, Canada

Email: Judith Miklossy - judithmiklossy@bluewin.ch

from Infectious diseases of the nervous system: pathogenesis and worldwide impact
Paris, France. 10–13 September 2008

Published: 23 September 2008

BMC Proceedings 2008, **2**(Suppl 1):P43

This abstract is available from: http://www.biomedcentral.com/1753-6561/2/S1/P43

It had been known for a century that the spirochete *Treponema pallidum* can cause dementia, cortical atrophy and amyloid deposition in the atrophic form of general paresis. Chronic bacterial infections are frequently associated with amyloid deposition and bacteria or their toxic components are powerful inflammatory stimulators and are amyloidogenic. Alzheimer's disease (AD), the most frequent cause of dementia, is a form of amyloidosis. The pathological mechanisms driving the accumulation of amyloid remain unclear. Recent observations showed that the biological hallmarks of AD can be induced in vitro or in vivo following exposure to bacteria or LPS. Spirochetes were observed in abundance in brains of AD patients and were cultivated in a modified Noguchi medium and/or in BSK II medium. Exposure of glial, neuronal and organotypic cultures to *Borrelia burgdorferi* strain B31 induced lesions similar to the pathology and the biological hallmarks of AD. In two AD cases where spirochetes were cultivated from the brain in BSKII medium, 16SrRNA gene analysis identified the microorganisms as *Borrelia burgdorferi sensu stricto (ss)* (strains ADB1 and ADB2). Here we analyzed whether exposure of glial, neuronal and organotypic cultures to these spirochetes may also induce an AD-type reaction in vitro. The results show that plaque-, tangle- and granulovacuolar-like changes, beta amyloid deposition, increased APP levels and tau hyperphosphorylation were all induced by these *Borrelia* spirochetes cultivated from the AD brains. The presence of intracellular OspA positive pleomorphic spirochetes and the detection of nuclear fragmentation in infected cells by TUNEL indicate that strains ADB1 and ADB2 are invasive. Spirochetes or their poorly degradable debris are powerful inflammatory cytokine inducers, activate complement, affect vascular permeability, generate nitric oxide and free radicals, induce apoptosis and are amyloidogenic. All these processes are involved in the pathogenesis of AD. The present observations represent further evidences that AD may well correspond to late stages of neurospirochetoses which include Lyme neuroborreliosis. The concept that microorganisms may be involved in the pathogenesis of AD is not new as it was discussed by Alzheimer and his colleagues a century ago. The old historic data and the new observations available indicate that highest priority should be given for this emerging field of research. Treatment of spirochetal infection may result in regression and, if started early, in prevention of dementia.