RETINAL ABNORMALITIES IN NEURODEGENERATIVE DISEASES

Maté Goldar, Carla
Bachelor’s Degree in Biomedical Sciences, Universitat Autònoma de Barcelona

Introduction

Neurodegenerative diseases are defined as hereditary and sporadic conditions which are characterized by progressive dysfunction, degeneration and death of neural cells. They tend to involve irreversible functional loss and represent a major concern in our current society due to their high and increasing incidence. Some of the main neurodegenerative disorders, such as Alzheimer, Parkinson and Multiple sclerosis, present visual disturbances and chemical changes within the retina.

1. Eye as a window to the brain (1): Changes in the retina of patients can help to predict changes in the brain, since the retina is a direct extension of the CNS. This early diagnosis can help solving the current lack of reliable non-invasive diagnostic techniques, limiting the application of an effective treatment.

2. Stem cell research offers the possibility of developing new therapeutic approaches to prevent and restore neuronal cell loss in the retina.

Retinal abnormalities in neurodegenerative diseases

Alzheimer

Primary neurodegenerative disorder and most common form of dementia. Most common symptoms are memory impairment, language deficits and a gradual loss of bodily function.

1. Electrodiagnostic tests: electrooculography (EOG) and visual evoked potentials (VEP).

2. Difficulties with reading, finding objects and recognizing colors, abnormalities in depth and motor perception and reduced spatial contrast sensitivity.

3. OCT and foveal loci.

4. OCT to determine RNFL and macular thinning.

Multiple sclerosis

Chronic immune-mediated disease of the CNS which affects the myelin sheath of the nerves at the brain and the spinal cord, showing heterogeneous decline in motor and cognitive functions. Two phenotypes: relapsing remitting MS (RR MS) and secondary progressive (SP) MS.

1. Demyelinating lesions in the white (WM) and grey matter (GM) of the CNS are the classical hallmark of the disease.

2. Decrease in visual acuity and contrast sensitivity, defects in binocular and color vision, diplopia and blurred vision, photophobia, excessive glare, photosensitivity, scotomas, abnormal eye movements, in retinal atrophy and inflammation. RNFL, and macular thinning.

3. OCT to determine RNFL thinning and correlate it with disease severity.

Methods

Data displayed in this poster has been obtained from scientific literature review of recent papers and reviews using the searching engines PubMed-MEDLINE and the scientific journals Nature and Science. Selection of papers mainly based on date of publication and quality of journal.


2. Stem cell therapies, cell reprogramming.

3. Describing retinal abnormalities in the main neurodegenerative diseases.

4. Preparing OCT as the major approach available for non-invasive retinal imaging methods and its potential application for early diagnosis, treatment monitoring and study of neurodegenerative diseases.

5.Speculating about the potential use of stem cells as a tool for future effective therapies.

Stem cell-based therapies

Stem cells are unspecialized and capable of giving rise to any type of cell by renewing themselves through cell division in response to external (microenvironment) and internal (genes) signals, remaining meanwhile in a quiescent state.

1. Neural stem cells (NSCs) are a potential therapeutic tool for neurodegenerative diseases. In the adult brain, they’re mainly localized in two tissue niches: the subventricular zone (SVZ) and the subgranular zone (SGZ). They can give rise to neurons (neurogenesis) and astrocytes and oligodendrocytes (glialogenesis).

2. AD gene-modified NSCs overexpressing choline acetyltransferase (ChAT) and the AD-degrading enzyme neuregulin (NEP) enhance regeneration, memory recovery and target AD pathology.

3. Oligodendrocyte progenitor cells (OPCs) and NSCs transplantation promote endogenous remyelination and neuronal regeneration, blocking also the uncoupled information.

References


Conclusions

1. Neurodegenerative diseases are considered as incurable.

2. The eye and the neurons of the retina of these patients represent a potential location for new therapies and early diagnosis.

3. OCT appears to be the main potential technique for early diagnosis and disease study purposes.

4. Stem cell based therapies and cell reprogramming techniques offer the potential to generate human retina cells, to develop specific human cell-based retina disease models and to open up new therapeutic strategies for the major neurodegenerative disorders.