Differential Diagnosis of Degenerative Brain Diseases

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Target Audience: Researchers that enter clinical neuroimaging topics and already experienced researchers that will enter the neurodegeneration topic

Introduction

With the increase of the mean age of our populations, neurodegenerative diseases are becoming more and more important – mainly the early diagnosis is of importance to allow for an early therapeutic intervention since neurodegeneration begins long before the patient experiences any symptoms. The diseases might present the strongest biological activity months or even years before clinical symptoms become obvious. Imaging with its sensitivity to detect even suitable changes in the brain may be of vital importance in this scenario. Even with the fact that the radiological evaluation of neurodegenerative diseases has markedly improved with the introduction of modern MRI techniques, the differential diagnosis between diseases is still a challenge. It required a detailed analysis of the normal aging changes and always includes the assessment of the clinical findings and laboratory tests.
Over the last years a couple of modern MRI techniques have been introduced which allow beside the morphological assessment also the visualization and quantification of physiologic or pathophysiologic parameters like perfusion, diffusion, fiber integrity or metabolic changes. These methods proved to provide very useful information especially in the early stages of disease.
There is quite a large number of neurodegenerative diseases, which can be divided into those with dementia as the leading symptom, and movement disorders caused by neurodegenaration. Some present with both symptoms as shown in the following graph. The typical imaging findings are summarized according to Orrisons textbook in the table.
To rule out secondary causes, like tumors , normal pressure hydrocephalus or other diseases, a neuroimaging study is mandatory in patients with mental decline of acquired movement disorders.

Summary of the different neurodegenerative diseases causing movement disorders and/or dementia. Most of the movement disorders also present with dementia and vice versa. The most common diseases are Alzheimer´s Disease, multiinfarct dementia and Parkinson´s disease

Disease	MRI Findings
Alzheimer´s Disease (AD)	Nonspecific Atrophy with preferential medial temporal involvement Normal signal intensity in basal ganglia
Normal pressure hydrocephalus (NPH)	Ventricular enlargement

	Normal outer CSF spaces Stretching of corpus callosum Signal void in aqueduct on PD and FLAIR
Creutzfeldt-Jakob Disease (CJD)	Non specific atrophic changes Rapidly progressive Symmetric T2 hyperintensities in striatum and thalamus
Pick´s Disease (FTD)	Frontal/temporal atrophy
Parkinson´s Disease	Nonspecific atrophy Decreased width of pars compacta
Multi System Atrophies	Premature T2 hypointensity in striatum
Huntington´s Disease	Atrophy of caudate and putamen>> globus pallidus
Wilson´s Disease	T2 Hyperintensities in putamen, thalami and brain stem Mild generalized atrophy
Amyotrophic lateral sclerosis (ALS)	Intermediate and T2 hyperintensities in intracranial corticospinal tracts
Leigh´s Disease	Symmetric T2 hyperintensities in globus pallidus, putamen and caudate Signal abnormalities in periventricular white matter and periaqueductal gray matter

Table: *Diseases and associated MRI findings*

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