

Role of conventional MRI in dementia: A study of elderly patients

Dr. Asma Manzoor (MD, Radiodiagnosis and Imaging)

Government Medical College (J&K)

Abstract:

The study sought to determine the role of conventional MRI in dementia in elderly patients. A total of 50 patients in the age group of (50-99) years underwent MRI scans in a transversal and sagittal orientation and an oblique orientation along the long axis of the hippocampus and the MRI findings were analysed visually and systematically scored in a standardized way. The study concluded that MRI is the preferred imaging modality in the evaluation of patients with dementia, with its superior resolution and multiplanar capability. MRI highlights the structural changes in brain and has a clear utility for differential diagnosis of dementia based on specific patterns of atrophy and signal changes which are characteristic of various forms of dementia such as AD, vascular dementia, FTD, etc.

Introduction:

Dementia, a clinical entity with myriad etiologies is characterized by a progressive deterioration of higher cortical brain functions, described as a global loss of memory, personality, and language (*Keyserling et al., 2005*). Dementia is defined by DSM IV (APA, 1994) as the development of multiple cognitive deficits manifested by both memory impairment and one or more of the following: aphasia, apraxia, agnosia, or disturbance in executive functioning. In addition, the cognitive deficits of each cause significant impairment in social or occupational functioning and represent a significant decline from a previous level of functioning (*Ebmeier et al., 2005*).

The most common causes of dementia are Alzheimer's disease (AD), vascular disease (in several forms as multifarct dementia, amyloid angiopathy and CADASIL), dementia with Lewy bodies (DLB) and frontotemporal lobar degeneration (FTLD), but there are many others (*Cohn-Hokke et al., 2012*). Alzheimer's disease, prototypical dementing disease, is a primary cortical dementia (*Barkhof et al., 2011*). Neurodegeneration in AD develops according to a specific sequence with preferential early and progressively anteromedial temporal atrophy. The role of MRI in the diagnostic process of AD is twofold, to rule out other causes of cognitive impairment and identify early onset AD for possible innovative therapy

and counselling. Vascular dementia (VD) is the second most common type of dementia after AD, especially in the elderly. The causes of vascular dementia are many and include common causes of acute stroke, such as atheroembolic disease and small vessel/arteriolar occlusive disease, and less common entities, such as CADASIL and amyloid angiopathy. In any case, brain imaging is essential for the diagnosis, as it reveals most of the (macroscopic) cerebrovascular pathology (*Barkhof et al., 2011*).

Review of Literature:

De Leon et al. (1996) conducted MRI studies in 405 patients to demonstrate the importance of imaging in the early detection of age related memory changes and in the prediction of dementia and a diagnosis of AD. The findings of this study revealed that imaging of the hippocampal region appears to be of potential diagnostic and predictive value in the clinical study of AD and showed the consistent involvement of the lateral temporal lobe in association with dementia. The findings also permit the identification of nondemented patients at increased risk for AD.

O'Brien et al. (1997) performed a study in 222 subjects using T1 weighted MRI. Subjects included healthy controls, patients with dementia of Alzheimer's type (DAT) and other forms of dementia, patients with alcohol related cognitive impairment and a group of 'memory complainers'. They concluded that temporal lobe MRI may have an important role in assisting with the clinical diagnosis of DAT, particularly its differentiation from various forms of dementia and other disorders that may cause diagnostic difficulties in clinical practice.

Wahlund et al (2000) evaluated the diagnostic value of visual inspection and volumetry of medial temporal lobe atrophy (MTA) on MRI and concluded that visual rating of MTA is a clinically useful method for differentiating Alzheimer's disease from controls and is both quicker and more accurate than volumetry.

De Leon et al. (2004) performed MRI and CSF studies in elderly subjects for early diagnosis of Alzheimer's disease and concluded that the combined use of MRI and CSF diagnostic measures for AD have the promise to improve the early and specific diagnosis of AD as well as to improve our understanding of the course of AD on both brain and behavior.

Hentschel et al. (2005) performed a study on the relevance of MRI in the clinical work-up of dementia and concluded that MRI improves early detection and differential diagnosis of dementia and MRI carries an added clinical value in the investigation of dementias.

Staekenborg et al. (2009) performed a study to determine the predictive value of magnetic resonance imaging measures of vascular disease (white matter hyperintensities [WMHs], lacunes, microbleeds, and infarcts compared with atrophy on the progression of mild cognitive impairment to dementia and concluded that medial temporal lobe atrophy and markers of cerebrovascular disease predict the development of different types of dementia in mild cognitive impairment patients.

Park and Moon (2016) reviewed the use of structural MRI in diagnosis of Alzheimer's disease and other neurodegenerative diseases and provided an overview about recent neuroimaging developments in the field of dementia with an emphasis on structural MR imaging and concluded structural MRI imaging of patients with cognitive decline has clear utility not only for exclusion diagnoses but also for the differential diagnosis of neurodegenerative disorders based on specific patterns of atrophy.

Objective of the Study:

The study was undertaken to evaluate role of conventional MRI in assessment of dementia in elderly patients.

Methodology:

This study was conducted in the Department of Radiodiagnosis and Imaging, Govt. Medical College and Associated Hospitals, Jammu. The patients from OPD as well as indoor patients with clinical suspicion/provisional diagnosis of dementia in elderly patients from the Department of Neurology/General Medicine/Psychiatry were inducted into the study. Patients of age group (≥ 50 years) were included. All the cases underwent MRI scan using **Siemens Magnetom Symphony 1.5 Tesla (Siemens Healthcare, Germany)**.

Standard Structural MR Imaging Protocol for dementia

1. The patients were placed in a supine position and a head coil was used for image acquisition. The routine MRI protocol for dementia included:
2. 3D gradient echo T1 weighted sequence with an additional inversional pulse sequence MPRAGE.
3. Transverse T2-weighted TSE/FSE sequence
4. Transverse IR TSE/FSE sequence
5. Transverse Susceptibility weighted imaging sequence
6. Diffusion weighted imaging

MRI scans in a transversal and sagittal orientation and an oblique orientation along the long axis of the hippocampus were analysed visually and the MRI findings in a patient of suspected cognitive impairment were systematically scored in a standardized way. After exclusion of treatable causes like SDH, infectious causes and hydrocephalus, signs of specific dementias were analysed systematically according to:

1. GCA scale for Global Cortical Atrophy
2. MTA scale for Medial Temporal lobe Atrophy
3. Koedam score for parietal atrophy
4. Fazekas scale for white matter lesions

Discussion and Conclusion:

Until recently, distinguishing one type of dementia from another could be difficult and was done chiefly on a clinical basis. The role of neuroimaging primarily was to exclude acute intracranial pathology, such as stroke or active infectious processes. As treatment and prevention strategies have advanced, so has understanding of the imaging manifestations of the various types of dementia. Imaging now plays an important role in the work-up of patients who have dementia, providing structural evaluation of the brain. The present study was undertaken to study the role of conventional MRI in evaluation of the spectrum of various diseases causing dementia in elderly patients. Fifty patients included in this study were of 50-99 years of age. Their decade-wise grouping was done (50-59, 60-69, 70-79, 80-89 and 90-99). The maximum number of cases (17 cases) was in the age group of 70-79 years, while the minimum number of cases was in the age group 90-99 years (1 case). Patients were also divided into two age groups 50-74 years and 75-

99 years to assess the atrophy of medial temporal lobe as the abnormal medial temporal atrophy score is different for the two age groups.

From the observations in this study, together with the data procured from literature, the following conclusions regarding role of conventional MRI in dementia in elderly patients are inferred:

- MRI is a safe and non invasive means of investigating a patient with dementia.
- MRI highlights the structural changes in brain and has a clear utility for differential diagnosis of dementia based on specific patterns of atrophy and signal changes which are characteristic of various forms of dementia such as AD, vascular dementia, FTD. In our study AD was found to be most prevalent among different causes of dementia followed by vascular dementia, mixed dementia in this order which is in accordance to previous studies and we were able to differentiate these.
- MRI allows the identification and exclusion of potentially treatable causes of cognitive impairment like SDH, NPH.
- Visual rating of medial temporal atrophy, global cortical atrophy, parietal atrophy can be applied on MRI images and could be implemented into standard clinical routines in dementia investigations. These visual rating methods are helpful in discriminating the magnitude of brain atrophy in ageing and higher rate of atrophy in patients with cognitive impairment.
- MRI scans are helpful in detection of rare cases of dementia like progressive supranuclear palsy, Creutzfeldt-Jakob disease.

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