

STUDY OF MRI FINDINGS IN BRAIN OF GERIATRIC PATIENT FROM 01.03.2016 TO 31.08.2016 (6 MONTHS)

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ABSTRACT

BACKGROUND

Geriatric brain show variety of diseases with different clinical presentation and associated with high degree of interindividual variability. The higher Tesla MRI with newer sequences is the choice of investigation, which helps in early detection, proper diagnosis and early therapeutic intervention of the disease in geriatric population.

MATERIALS AND METHODS

The present study was carried out in all the geriatric patients referred from SCB Medical College in a particular time period to Add Annex Healthcare Center, Cuttack, i.e. in 6 months from 01.03.2016 to 31.08.2016. All these cases undergone MRI scan in 1.5T GE Optima machine. The sequences taken are conversational sequences along with FLAIR and DWI. Some of the patient has undergone contrast study. The findings were correlated with clinical findings.

RESULTS

White matter changes are more prevalent in the geriatric brain followed by atrophy and neoplastic disease. Most of the geriatric patients comes with geriatric syndrome show white matter changes. The prevalence of the disease are comparable with other studies reviewed from literature. The clinical findings depends upon the type and location of lesions.

CONCLUSION

Most of the geriatric syndromes are due to white matter changes. Early therapeutic intervention improves their lifestyle and delays the deterioration of the symptomatology.

KEYWORDS

WMC- White Matter Change, PVWMC- Periventricular White Matter Changes, DWMC- Deep White Matter Change, NPH- Normal Pressure Hydrocephalus, NCC- Neurocysticercosis, SOL- Space Occupying Lesion.

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BACKGROUND

The unprecedented sensitivity of MRI in detecting pathologic alteration of the central nervous system¹⁻⁵ has yielded disquieting results when applied to the brain in any age group and more so in geriatric brain. Development of newer techniques/sequences with higher magnetic field MRI machines makes the task more easier and less time consuming in detecting the minute changes in brain. In India, 7.5% of population are of more than 60 years of age (2011 census) out of which 75% are staying in rural areas and 76% are dependent on other family members. In above scenario, the radiologist and geriatrician and the

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Government of India has challenging role in diagnosis and management of geriatric patient. Hence, MRI as investigating tool helps a lot for diagnosis of underlying pathology in these population.

MATERIALS AND METHODS

All the patients referred from SCB Medical College to add Annex Healthcare Center from 01.03.2016 to 01.08.2016 above the age group 60 years were taken in the study group. Standard protocols T1WI, T2WI, FLAIR proton density images and DWI, other sequence like and DTI, MRV, MRA and MRS if required. During MRI study, the use of the contrast media for MRI study was decided by radiologist when required. Around 15% of cases have undergone contrast study.

RESULTS

Total no. of patients = 115 (Males = 89 and Females = 26) age group (60 to 85 years).

MRI finding and radiological diagnosis.

1. Normal study = 19 = 16.5%.

2. Atrophy = 25 = 21.7%.
3. White matter lesions/ischaemic changes. (Overlapping with atrophy and among these findings).
 - Infarcts (larger lesion) = 20-17.39%.
 - WNL (leukoaraiosis).

Lacunar infarct=32	} Total 78=67.8% (overlapping)
Patchy & confluent WMC=25 (DWMC)	
Periventricular WMC= 21	

- Metabolic=10,020.
 - Radiotherapy change=1.
4. Haematoma of = 7 = 6.08%.
 5. NPH = 6 = 5.21%.
 6. Infection (NCC and encephalitis) = 2 (one each) = 1.739%.
 7. Neoplastic disease = 12 = 10.43%.
 - (a) Benign- (8) 5.21%.
 - Meningioma- 4.
 - Pituitary adenoma = 2.
 - (b) Malignant= (6)- 4.35%.
 - Residual/recurrence = 1.
 - Intracranial metastasis = 2.
 - Calvarial metastatic- 1.
 8. Vascular.
 - Aneurysm (vascular) = 1.

The USE of term White Matter Changes (WMC) and White Matter Lesion (WML) are taken as same entities. Accordingly, DWMC and PVWMC are same as DWML and PVWML.

Data Analysis

The MRI findings in this study group were compared with other studies, i.e. A.S. Brett reviewing the studies of Bryan R.N. et al and Yue N.C. et al.⁶ In our study, the prevalence of infarct (hemiparesis) is almost same as the prevalence in the above said study (17.392). But, the prevalence of the small white matter lesions like DWMC and PVWMC area comparatively much more high in our study (67.88% versus 36%). This variation could be due to different geographical variation with different socioeconomic status, food habits, smoking habit, health awareness with early inference, etc. The WNL in our study are also much higher than the findings in the Rotterdam study,⁷ i.e. 67.88% versus 27%. All these findings are overlapping with atrophy, infarct, lacunar infarct and also with both DWMC and PVWMC.

The prevalence of neoplastic lesions are also much higher in our study group than other study, i.e. 10.43% versus 1.7% (Bryan R.N et al).

In our study group, other MRI findings encountered are haematoma NPH, atrophy and infection. Most of these are associated with WMC. Besides these findings around 16.5% are normal studies without any WMC.

Clinical Findings and Other Disease

The common clinical findings, which are recorded in this study group are as follows. Disturbance in gait balance with fall, cognitive impairment, depression, urinary incontinence, hemiplegia, unconsciousness or altered sensorium joint pain and body pain, headache and reeling of head and dizziness, nausea and vomiting, forgetfulness and decline in intelligence and visual disturbance.

The associated systemic disease, which come across in our study group are diabetes, hypertension, cardiac disease and arthropathy. Most of the patients has taken irregular treatment and some are without any treatment.

DISCUSSION

Leukoaraiosis is the term, which describes the radiographic abnormalities of periventricular or subcortical white matter,⁸ these are PVWML and DWML, respectively. WMC/WML are ill-defined hypodensities on CT. On MRI, which is more sensitive than CT on delineating the lesions, they appear hypointensities in T1W images and hyperintensities in T2W, proton density and FLAIR images. The FLAIR sequences is the best to assess the sensitivity of DWMC. The lesions more near to ventricles with largest diameter adjacent to ventricle are PVWMC. Otherwise, they are called DWML. Nowadays, DTI (diffuse tensor imaging) technique provides integrity of white matter tracts, hence considered to be the best technique to assess the WMC. These are significantly associated with increased age, hypertension, smoking and lower education. Hence, these lesions are lower in other studies in comparison to our study, i.e. European Population-Based Study (Helsinki) 39%.⁹ The participants with psychiatric disorders such as depression or dementia have reported to have higher prevalence rate of WMCS than general population,¹⁰ but quite a good number of patients with psychiatric disorder also show normal MRI study in our study group. These are mostly around 60 to 65 years of age, i.e. comparatively early geriatric age.

Regarding pathophysiology of WML, it is characterised by partial loss of myelin, axons and oligodendroglial cells, mild reactive astrocytic gliosis with sparsely distributed macrophages as well as stenosis resulting from hyaline fibrosis of arterioles and the smaller vessels. Other mechanism is blood brain dysfunction leading to chronic leakage of fluid and macromolecule in white matter, which indicates damage to brain parenchyma in area of WMC, but is not specific to any one particular pathophysiology process. Several aetiologies including ischaemic, inflammatory, toxic, metabolic, infectious and degenerative conditions can lead to presence of hyperintense lesions in T2-weighted images in MRI scan.¹¹ WML are strongly correlated to cardiovascular disease most likely the result of cerebral ischaemia.¹² Hence, the location of these lesions are mostly in watershed areas. Furthermore, an elevation in CSF glutamate concentration, which is considered to be the result of cerebral ischaemia has been reported in participants with leukoaraiosis.¹³ Histological studies by Van Sweeten and colleagues¹⁴ and Fazeka's and others¹⁵ found a strong correlation between WML and presence of

demyelination astrocytic gliosis, variable loss of white matter fibers, small cavitations and marked arteriolosclerosis. All the above-said studies support the fact that WMLS in geriatric population are due to hypoperfusion in watershed areas.

In our study group, other risk factors or diseases, which are strongly associated with WML are age, diabetes, hypertension with irregular treatment and cardiac disease. The closed association of cerebral WML with age has been demonstrated by population-based cohort studies.¹⁶ Recent prospective study by Taylor and colleagues demonstrate the significant association between diabetes and WMC.¹⁷ The atherosclerosis risk in community study and other studies also concluded that hypertension is cross-sectionally associated with increased odds of WML, more over uncontrolled hypertension had greater odds of WMC than well-controlled hypertension.¹⁸ In some other studies, blood pressure dysregulation in elderly people, i.e. postural hypotension and hypertension were also closely related to WMC.¹⁹

Atherosclerosis is the main culprit associated with cerebral WML in above-said risk factors, which has been shown in cross-sectional study.²⁰ This is due to impaired cerebral blood flow proved by Meguvo et al and Marstrand et al in areas of WML.²¹

From review of different literature, recently some genetic factors has been attributed for cerebral WMC by few studies. This can be correlated with the findings in our study, i.e. some geriatric patients show has absolutely normal MRI scan, whereas other have WMC showing individual variations probably due to genetic factor. Certain geriatric disease like CADASIL (cerebral autosomal dominant arteriopathy with subcortical infarcts and leukoencephalopathy), which is due to mutation in NOTCH3 gene shows prevalence of characteristic periventricular hyperintensities or deep white matter hyperintensities in MRI study of these patients is 96%.²² Hassan et al²³ has demonstrated that ACEDD genotype occurred more often in leukoaraiosis than those without.

Relationship of cerebral white matter changes with different clinical findings in the geriatric patients are due to involvement of different neural pathways according to the locations of the WMLS and also by other factors. Hence, DTI plays a vital role to detect the impairment of integrity of white matter tracts. The disturbance in gait and balance with or without fall are due to several factors such as medication use, body pain, sensory impairment, degenerative joint disease, acquired musculoskeletal, deformities, stroke and postural hypertension. Besides these factors, a large proportion of gait and balance abnormalities show cerebral white matter changes in our study, which can be correlated to the studies by Briley et al. All the NPH patient also show gait disturbance along with urinary incontinence with or without WMC.

The WML may interrupt frontal circuit responsible for normal gait and balance or they may interfere with long loop reflexes mediated by deep white matter motor tracts.²⁴ In addition, the distributions of PVWMC and DWMC

could interrupt the descending motor fibres arising from medial cortical areas, which are important for lower extremity motor control.²⁵ Similarly, WMC in right inferior frontal regions and selected WM tracts predict incontinence and its severity and degree of bother. The study confirmed a critical role of the cingulum, anterior corona radiata and superior fronto-occipital fasciculus in bladder control.²⁶

The common psychiatric symptoms are encountered in our study are intelligence decline, forgetfulness, cognitive impairment and depression. These symptoms are mostly associated with atrophy (global regional atrophy) and WML. Besides these findings, few are associated with infarct and microbleed from literature study. The cognitive impairments are believed to be due to involvement of the fibres connecting the frontal cortex and subcortical structures. Similarly, depression is due to dysfunction of frontostriatal neural systems and their limbic hippocampal connections. The WML in these areas may contribute to depression.²⁷ Hence, the location of WML and loss of brain parenchyma gives corresponding clinical presentations of different geriatric patients.

Other group of symptoms are headache, dizziness, nausea, vomiting, convulsion, altered sensorium, unconsciousness, hemiplegia, hemiparesis and visual disturbance. Most of these symptoms are due to space occupying lesion or CVA. Very few of the patients present with headache without any lesions in MRI scan are advised to exclude other cause of headache. Infarcts and intracerebral haematoma are associated with hemiplegia, altered sensorium, vomiting, urinary incontinence, etc. One of intracerebral haematoma found out to be aneurysm associated with subarachnoid bleed.

Most of the SOL in our study group, which include benign and mitotic intracranial tumours present with headache, nausea, vomiting and convulsion. But, visual disturbance with headache are presented by two of the patient with pituitary adenoma. Most of these neoplastic disease undergone surgery, out of which, one subsequently followed up, but not included in our study. But, two other cases with known case of intracerebral tumour undergone surgery and radiotherapy were included in our study as the primary MRI scan was done in other center. One of these patient show recurrence and other show post radiotherapy extensive white matter change. Other MRI finding in two of the geriatric population in our study were diagnosed as neurocysticercosis and encephalitis by their typical clinical presentation and neuroimaging findings.

Prevention and Early Intervention

Periodic health checkup, early diagnosis with effective treatment can prevent or delays the grave outcome of the geriatric diseases. Hence, it is the duty of the clinician and radiologists to diagnose properly and give proper treatment, which can achieve the goal. Moreover, it is the duty of state to make available of the geriatric healthcare facilities in the rural areas, where around 75% of geriatric population are living so that they can get benefit of this

system, thereby prevent the morbidity and grave outcome of geriatric disease.

CONCLUSION

Leukoaraiosis or cerebral white matter lesions are common radiological findings in elderly people followed by atrophy, CVA and intracranial neoplasm. Common geriatric syndrome such as cognitive impairment, gait disturbance, depression and urinary incontinence have been shown to be closely associated with WMLS.

The white matter lesions has many risk factors like age, hypertension, diabetes, atherosclerosis and the NOTCH3 genmutation. The late-life disability and functional impairment can be prevented by modifiable cardiovascular disease risk factors.

Other serious diseases like CVA, intracranial neoplasm and infection can also be treated effectively to prevent the grave outcome.

As there is increased trend of geriatric population in country like India and state like Odisha, health education, proper healthcare and improvement of socioeconomic status and availability of basic needs in rural areas can decrease the prevalence of the geriatric diseases. Hence, this challenge is to be taken by the government and every individual in the society to overcome this social problem.

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