Original Article

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Radiology Section

Magnetic Resonance Imaging in Psychiatric Patients in Central India: A Prospective Study

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ABSTRACT

Introduction: Psychiatric illnesses are generally considered different from other medical disorders simply because of social stigma. Certain neurological disorders are present with psychiatric symptoms. As psychiatric illnesses are treatable, neuroimaging can help to identify the underlying pathology and timely intervention will have positive impact on patient's outcome. Magnetic Resonance Imaging (MRI) is the imaging modality of choice for neuroimaging of psychiatric illnesses.

Aim: To identify the underlying treatable cause of disease and to discuss the MRI features of different psychiatric disorders.

Materials and Methods: A cross sectional study was done in the department in which 209 psychiatric patients were referred from the department of psychiatry which underwent MRI Brain after taking informed consent. Patient age ranges from 8 to 82 years with mean age of 38 years. All were referred to rule out any organic cause.

Results: Out of 209 patients, 99 (47 %) were normal and 110 (53%) showed abnormal MRI findings. In the present study commonest primary psychiatric diagnosis was schizophrenia (n=41) followed by brief psychotic episode (n=34). Out of abnormal scans, 35 showed atrophy, 31 showed infarct and 28 showed white matter pallor. The present study showed that neuroimaging results were helpful in supporting diagnosis in 19/209 (8%) Newun anticipated finding requiring intervention in 7/209 (3%) and Impact on initiating the management in 12/209 (5%) patients.

Conclusion: Neuroimaging in psychiatric patient not only rules out underlying organic cause but also helps in predicting prognosis of particular disease. MRI is the modality of choice in neuroimaging in psychiatric patients.

Keywords: Neurological disorders, Neuroimaging, Psychiatric Disorders

INTRODUCTION

Psychiatric disorders are generally considered as different from any other medical disorders. They are mostly underreported in rural population due to number of factors like social taboo, lack of medical facilities, unawareness, ignorance and low socioeconomic status. Even though they feel that there is something wrong with person's mental health, they will seek the advice of quack instead of proper medical evaluation. In some rural population of India this is considered as curse from god and seeks the help of occultist for the same.

Most of these psychiatric disorders are due to functional disturbances. There are some organic disorders which presents with psychiatric symptoms [1,2]. These treatable structural causes have led to neuroimaging. Till date there are number of studies that have addressed role of neuroimaging in psychiatric disorders [3-5] but the present study included wide range of psychiatric diagnosis based on the International classification of Diseases (ICD) 10 criteria [6] to elicit the role of neuroimaging. Apart from diagnosis, MRI is also having role in drug development in psychiatric disorders and helps in monitoring treatment [7]. In the past, role of neuroimaging in psychiatric disorders was simply to rule out any structural abnormality, however with recent advances in Magnetic Resonance neuroimaging, it is possible to correlate MRI findings with clinical findings [7].

The role of neuroimaging in psychiatric patients is mainly to rule out presence of any organic cause which is amenable to treatment. The available modalities for neuroimaging are CT and MRI. Out of these two, MRI is superior because of its multiplanar imaging capability, better soft tissue resolution and use of nonionic radiation.

There are many studies done in the past regarding features of neuroimaging in psychiatric disorder [8]. Previously the study of CT scan in psychiatric patients was reported. Not

many studies are reported in literature regarding the MRI brain findings in patients with psychiatric disorders.

We conducted a cross sectional study in patients referred from department of psychiatry for brain imaging to assess the role of MRI in psychiatric disorder and its utility in management of such patient.

MATERIALS AND METHODS.

A cross sectional study was done in 209 patients referred from the department of psychiatry for MRI brain from August 2017 to June 2018. Informed consent was obtained in all patients who were part of this study. Exclusion criteria were patients with claustrophobia, cardiac pace maker and MR non compatible implants. The indications for MRI brain study were based on clinical findings of psychiatrist, duration of symptoms, psychiatric diagnosis based on the ICD 10 criteria [6]. The most common indication for MRI brain was to rule out the structural lesion in patients with psychiatric diagnosis. After MRI, the abnormal scan with treatable cause helps in patient management.

The analysis of medical records of all patients was based on specific parameters which included age, sex, primary psychiatric diagnosis, duration of symptoms, significant past medical history, previous history of head injury and seizures. Cognitive and neurological examinations were performed as part of routine clinical evaluation.

The age of patients who underwent MRI brain study ranged from 8 years to 82 years with mean age of 38 years. The duration of symptoms ranges from 1 day to 17 years. There were 98 females and 111 males in the study.

All MRI studies were performed on 1.5 HD XT 16 channel 1.5T GE MRI machine using brain coil. MRI brain was done in all patients using following sequences:

Axial T1WI (TR-2023 TE-8.7); (Slice thickness-5mm); Duration of sequence-2:24 min, Axial T2WI; (TR-4623 TE-93); (Slice thickness-5mm); (Duration of sequence-2:33 min), Axial FLAIR (TR-8006 TE-90.7); (Slice thickness-5mm); (Duration of sequence-2:56min), Axial diffusion weighted imaging B-1000 (TR-6000 TE-97.7); (Slice thickness-5mm); (Duration of sequence-1:24 min), Sagittal T2WI (TR-4662 TE-89); (Slice thickness-5mm); (Duration of sequence-2:15min), Coronal T2WI FLAIR; (TR-8000 TE-86); (Slice thickness-5mm); (Duration of sequence-2:56 min), Axial susceptibility weighted imaging (TR-749 TE-47.6);(Slice thickness-5mm); (Duration of sequence-3:24 min).

MR venogram was done in 5 patients after 10 ml of GadopentatateDimeglumine injection containing 469 mg (0.5mol/L) of Gadopentatic acid, presenting with schizophrenia, brief psychotic episode, dementia, somatoform disorder and major depressive disorder as primary psychiatric diagnosis.MR venography done using sequence with TR-30, TE- minimum; slice thickness of 1.6 mm; duration of sequence-4:28 min.

MRI contrast study was done in one patient presenting with somatoform disorder as primary psychiatric diagnosis.10 mL of Gadopentatate Dimeglumine injection containing 469 mg (0.5mol/L) of Gadopentatic acid was injected. Axial T1 weighted post contrast imaging (TR-2023 TE-8.7);(Slice thickness-5mm),coronal T1Weighted post contrast imaging (TR-2023 TE-8.7); (Slice thickness-5 mm), Sagittal T1weighted post contrast imaging (TR-2023 TE-8.7); (Slice thickness-5 mm) was done.

MRI spectroscopy was done in patient with brief psychiatric episode as primary psychiatric diagnosis using sequence with TR-1000, TE-144; voxel thickness-15 mm; duration of sequence-4:20 min.

STATISTICAL ANALYSIS

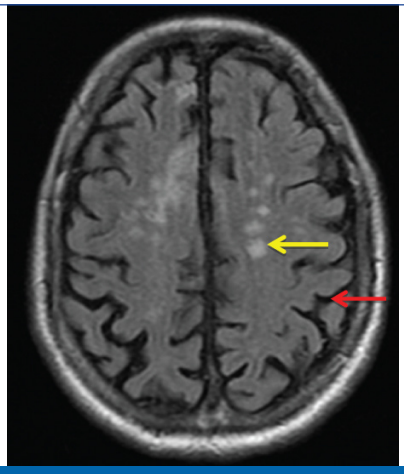
The patient characteristic data and MRI results were analysed by using Microsoft Excel sheet. The frequency and percentage of abnormal scan results calculated from Microsoft Excel sheet. All these scans were reported by single radiologist to eliminate subject bias.

RESULTS

Out of 209 patients, 99 patients (47%) did not show any abnormality. A total of 110 patients (53%) showed abnormal MRI findings [Table/Fig-1]. Out of abnormal scans, maximum showed atrophy (n=35) [Table/Fig-2] followed by infarct (n=31) and white matter pallor (n=28) [Table/Fig-3].

Primary psychiatric diagnosis	Number of patients	Normal scans (%)	Abnormal scans (%)
Schizophrenia	41	19 (46%)	22 (54%)
Schizophreniform disorder	14	04 (28%)	10 (72%)
Anxiety	11	11 (100%)	00 (0%)
Brief psychotic episode	34	19 (55%)	15 (45%)
Dementia	21	03 (14%)	18 (86%)
Somatoform disorder	19	08 (42%)	11 (58%)
Headache	15	10 (66%)	05 (34%)
Bipolar disorder	09	02 (22%)	07 (78%)
Manic episode	06	04 (66%)	02 (34%)
Conversion disorder	11	04 (36%)	07 (64%)
Major depressive disorder	17	08 (47%)	09 (53%)
Alcohol dependence	04	00 (0%)	04 (100%)
Obsessive Compulsive Disorder	07	07 (100%)	00 (0%)
Total	209	99 (47%)	110 (53%)

[Table/Fig-1]: Frequency and percentage of normal and abnormal scans in relation to psychiatric diagnostic category.

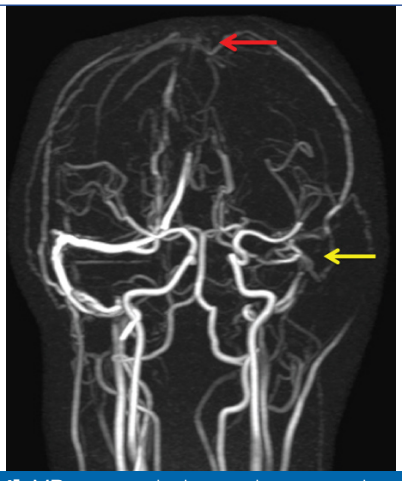


[Table/Fig-2]: Axial FLAIR image shows the cerebral atrophy in the form of prominence of sulcal spaces (Red arrow) and white matter pallor (yellow arrow).

Primary psychiatric diagnosis	Atrophy	White matter pallor	Infarct	Other
Schizophrenia	05	12	04	01 (sinus thrombosis)
Schizophreni-form disorder	03	02	04	01 (haemorrhage)
Anxiety	-	-	-	-
Brief psychotic episode	07	03	03	01 (sinus thrombosis), 01 (metabolic changes)
Dementia	03	02	11	01 (NPH), 01 (sinus thrombosis)
Somatoform disorder	03	-	02	01 (sinus thrombosis), 04 (Decreased pituitary size), 01 (NCC)
Headache	-	03	01	01 (NPH)
Bipolar disorder	03	03	-	01 (NPH)
Manic episode	-	-	02	-
Conversion disorder	04	-	02	01 (NPH)
Major depressive disorder	04	03	01	01 (sinus thrombosis)
Alcohol dependence	03	-	01	-
OCD	-	-	-	-
Total	35	28	31	16

[Table/Fig-3]: Frequency of abnormal brain scan results for different psychiatric diagnostic categories.
NPH: Normal pressure hydrocephalus; NCC: Neurocysticercosis; OCD: Obsessive Compulsive Disorder

The mean age in the present study was 38 years. In patients of schizophrenia, White matter pallor was the most common finding in 12 patients (29%), followed by atrophy in five patients (12%) and infarct in four patients (9%). In patients of schizophreniform disorder infarct was most common finding in four patients (28%). In patients with dementia, infarct was the most common abnormality seen in 11 patients (52%). It was found that decreased pituitary size was the most common finding in patients of somatoform disorder i.e., in four patients (21%). In patients of manic episode only finding we reported was infarct seen in two patients (33%). In rest of the psychiatric disorders, cerebral atrophy was the most common finding. No specific relation between duration of symptoms and abnormal scan was found e.g., patient presented with somatoform disorder on 3rd day had sagittal sinus thrombosis [Table/Fig-4] and patient with schizophrenia since 10 years had normal scan.



[Table/Fig-4]: MR venography image shows superior sagittal sinus thrombosis (red arrow) and left transverse sinus thrombosis (yellow arrow).

DISCUSSION

The true reported incidence of psychiatric patient is always less in India than actual due to many factors like social stigma, lack of education, reluctance to seek medical advice and in remote places of India it is due to lack of proper medical facilities. The present study which is conducted in the hospital situated in central India caters the rural population with low socio-economic status. This is the reason for limited sample size in the present study. However, in western population and in urban population of India patients and their relatives promptly seek medical advice for psychological illness and insist for neuroimaging.

Psychiatric disorder can occur at any age, as in the present study age range is from 8 years to 82 years with mean age of 38 years. This proves that awareness in the people regarding mental health is rising. There is slight male predominance in the study (male n=111, females n=98). This may be due to gender bias in seeking medical help in Indian society.

In the present study the most common psychiatric diagnosis was schizophrenia followed by brief psychotic episode and dementia. This is in contradiction to previous study by Elheis M et al., here they had included mainly elderly patients so the commonest psychiatric diagnosis in their study was dementia [9]. As we include patients of all groups which include elderly as well as adolescent, the dementia remain the third most common diagnosis.

The duration of illness in the present study ranges from 1 day to 17 years. However, there was not found any positive correlation between abnormal scan and duration of illness.

There are wide variations in abnormal scans in psychiatric patients reported in previous studies due to number of reasons such as different study population, variable selection of patient by psychiatrist, variable duration of illness and different age groups [9].

In most of the previous studies, as the patients are referred from psychiatry department after clinical examinations it would be expected of higher frequency of abnormal scans compared with randomly selected patients. Frequency of abnormal brain scans in psychiatric patients are ranging from 6.8% to 53% as reported in previous studies [3,10-12]. In the present study also as all patients are referred from psychiatry, so the expected incidence of abnormal scans was higher. However, in the present study incidence was 53% i.e., out of 209 subjects, 110 showed abnormal scan which is in consensus with previous studies. A study conducted by Elheis M et. al., showed a higher incidence (64%) which is probably due to large number of elderly patients in their study population [9]. In comparison to this study, incidence in the present study was less as we included wide range of patients of all age groups with mean age of 38 years.

Various studies have provided evidence that psychiatric disorder have definite neuropathologic basis [7]. There are some MRI patterns noted in psychiatric disorders [7].

Those are as follows:

Schizophrenia: Decreased frontal lobe, temporal lobe, cerebellum, total brain volumes, increase lateral ventricular volume and cortical gray matter thinning.

Bipolar Disorder: increased volume of lateral ventricle, third ventricle, high signal intensity in cortical frontal lobe and subcortical region.

Major Depressive Disorder: Gray matter loss and volume reduction in subregions of prefrontal cortex, medial temporal lobe, amygdala and hippocampus.

Anxiety Disorder: Decreased volume in anterior cingulate gyrus, insula, amygdela and hippocampus [7].

Attention deficit Hyperactive Disorder: Decreased anterior cingulate cortex, prefrontal cortex, striatum and cerebellum volumes, cortical gray matter thinning.

In the present study out of 209 patients, 110 patients had finding on neuroimaging. In our study in patients with clinical diagnosis of schizophrenia, 22 had abnormal scan. Out of which, 5 patients had atrophy, 12 had white matter pallor, four patients had infarct and 1 had deep venous sinus thrombosis. So in the present study majority had non-specific white matter pallor. This is contradicting with previous study [9] which says that cerebral atrophy is most common finding in patients with schizophrenia as psychiatric diagnosis. This is due to cohort in the present study includes extremes of ages and variable duration of symptoms.

Bipolar disorder was seen in nine patients in the present study out of which three had cerebral atrophy, three had white matter pallor and one had normal pressure hydrocephalus which is consensus with previous study [7].

In dementia, the commonest positive finding on neuroimaging is infarct which is also in the present study. This is in consensus with previous studies [9].

In somatoform disorder, the commonest positive finding was decreased pituitary size followed by cerebral atrophy in our study. Other less common finding was infarct, sinus thrombosis. In our study one had neurocysticercosis. However, study conducted by Delvecchio G et al., showed gray matter volume reductions in hypothalamus, left fusiform gyrus, right cuneus, left inferior frontal gyrus, left posterior cingulate, and right amygdala [13].

In the present study, patients with headache had increased white matter signal intensities, infarct and normal pressure hydrocephalus. A large review of 3026 scans of patients with headache showed that only a minority of patients suffered from a serious disease that could be diagnosed with cerebral imaging: (a) 0.8% brain tumours; (b) 0.2% arteriovenous malformations; (c) 0.3% hydrocephalus; (d) 0.1% aneurysm; (e) 0.2% subdural haematoma; (f) 1.2% strokes, including chronic ischemic processes [14].

Various cross-sectional studies been associated with less grey matter volume in prefrontal brain areas manic episode [15].

Patients with manic episode in the present study had infarcts.

Study conducted by Nicholson TR et al., showed Significantly smaller left thalamic volumes in patients with conversion disorder [16]. Patient with conversion disorder had atrophy followed by infarct and normal pressure hydrocephalus in our study.

Alcohol dependent patients in our study had cerebral atrophy and infarct on neuroimaging.

Patients with anxiety disorder and obsessive compulsive disorder did not have any structural abnormality. In previously published studies, they had mentioned that volume loss in these conditions [7].

In the present study, all these patients were referred for neuroimaging just to rule out any structural abnormality. Most of our patients had neurodeficits i.e., focal neurological signs, confusion, and forgetfulness. So the number of expected positive scans was more. In literature it has been reported that there is positive correlation between focal neurological findings on clinical examinations and positive neuroimaging [10].

One study showed that when a history of neurological/organic mental signs were absent then brain scans were normal in 75 percent of cases but when both were positive scans were abnormal in 74 percent of cases and when both history/examination and Electroencephalography (EEG) was abnormal the scan were abnormal in 92 per cent of cases [8].

The present study showed that neuroimaging results helpful in supporting the diagnosis in 19/209(8%) New unanticipated finding requires intervention in 7/209 (3%) and Impact on initiating the management in 12/209 (5%) patients [Table/Fig-5]. Dementia patients were benefited by neuroimaging that in patients with infarct antithrombotic treatment was started. We reported intracranial pathology in one patient in the form of neurocysticercosis in patient presenting with somatoform disorder as psychiatric diagnosis.

Impact	Psychiatric diagnosis	Number of patients (%)	Total patients
Helpful in supporting diagnosis	Atrophy in Dementia Atrophy in schizophrenia White matter pallor in schizophrenia	03 (16%) 05 (12%) 11 (26%)	21 41 41
New unanticipated finding requiring intervention	Sinus thrombosis in schizophrenia Sinus thrombosis in dementia NPH in dementia NPH in bipolar disorder Sinus thrombosis in somatoform disorder Neurocysticercosis in somatoform disorder Sinus thrombosis in major depressive disorder	01 (02%) 01 (04%) 01 (04%) 01 (11%) 01 (11%) 01 (11%) 01 (14%)	41 21 21 09 19 19 17
Impact on initiating the management	MRI scan showing infarct in Dementia: commencement of vascular prevention therapies. MRI scan showing infarct in headache: commencement of vascular prevention therapies.	11 (52%) 01 (06%)	21 15

[Table/Fig-5]: Frequency and percentage of MRI brain results that influenced clinical care.

Many studies had variable inference in determining the usefulness of brain scan in diagnosis and management of psychiatric conditions. A study with a pathologically confirmed cases showed that neuroimaging can help to identify vascular dementia or vascular components of Alzheimer's disease thus had impact on its management [17].

Another study reported that neuroimaging helps in diagnosis, management and prognosis of psychiatric conditions was influenced in 11.7 per cent of patients in duration of 37-month period [18]. In a series of 136 patients with chronic schizophrenia, on CT scan subdural haematoma reported in 2 patients and meningioma in 1 patient which were unexpected clinically [19]. Reversible organic pathology on CT brain have been identified in 1.6 per cent to 4.9 per cent of psychiatric diagnosis [10,12].

There are many studies suggest indication for neuroimaging those include patient with history of head injury/stroke/other neurological disease, organic mental sign e.g., Confusion or cognitive decline, first psychiatric symptom after the age of 50 years.

In neuroimaging, MRI has replaced CT in almost all the conditions so as in psychiatric patients. MRI gives finer detail of brain morphology but cost and time constraints are limiting factors in MRI. As Computed Tomography (CT) is readily available, cheaper and quicker and can be done in patients who are not suitable for MRI.

The present study had included wide age range so different neuroimaging findings were expected and most of these patients were already diagnosed with psychiatric disorder so positive brain scans were more.

LIMITATION

The limitation of the present study is that we have small sample size, we don't have control group to compare with and we don't have equal number of patients in each psychiatric subgroup.

CONCLUSION

It was concluded that imaging plays pivotal role in psychiatric patients as it helps in identifying underlying organic cause which can be treatable. Imaging provides valuable information on the prognosis of particular disease. However, though we have almost 53% of positive scans, neuroimaging in psychiatry patients needs to be carefully scrutinize to make cost effective use of MRI. Psychiatrist should identify appropriate clinical and other criteria to define indication for neuroimaging in psychiatry.

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