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A STUDY OF CORRELATION OF DEPRESSION AND HIPPOCAMPAL VOLUME

Nidhi Jain[1], Kajal Agrawal[2]

[1]Junior Resident, Department of Psychiatry, R D Gardi Medical College, Ujjain

[2]Junior Resident, Department of Radiodiagnosis, R D Gardi Medical College, Ujjain

ABSTRACT:

INTRODUCTION: Major depressive disorder is a common, severe and debilitating illness with increasing rate of morbidity and mortality. The biological model used to conceptualise the course of depression involves structural changes in hippocampus. Reduced plasticity of hippocampus has been found to be correlated to stress and depression in many studies. Depression is associated with hypercortisolaemia which down-regulates the HPA axis and damages hippocampal neurons. Executive deficits are very common in depression which strongly suggests hippocampal involvement over the course of depressive illness.

AIM: To look for changes in hippocampal volume due to depression.

METHODS: The study will include 60 patients between ages 18-65 interviewed using HAM-D Scale Questionnaire and had MRI Brain with a 3D IR-PREP sequence. In this sequence we acquire the 3D data and reformat hippocampal region and measure antero-posterior superior-inferior and transverse dimension with volume estimate. The data was then be pooled, tabulated and subjected to statistical analysis.

RESULTS AND DISCUSSION: The depressive patients had a significant correlation with Hippocampal Volume which is observed on the both sides and its inversely related to increasing duration and severity. The correlation of Hippocampal Volume with Duration is significant at; For the Right Side (beta=-0.57,$p<0.00$, R^2= 0.231) and For the Left Side (beta=-0.05, $p<0.00$, R^2 =0.268). The correlation of Hippocampal Volume with Severity is significant at; Right Side (beta=-0.038, $p<0.002$,R^2 =0.155) and for the Left Side (beta=-0.26, $p<0.029$, R^2 =0.08).

CONCLUSION: There is a significant correlation in role of hippocampus and the pathology of depression. It has been found that there is inverse correlation of hippocampal volume and increasing severity and duration of illness.

INTRODUCTION:

Major Depressive Disorder(MDD) is one of the most prevalent and debilitating psychiatric illness with increasing prevalance worldwide. The recent World Mental Health Survey reported estimated average prevalance of 9% in India.[1] MDD is characterised by impairments in cognition, emotional regulation, memory, motoric functions, motivation and neurovegetative symptoms.[2] There are multiple factors at play for the causation and progression of Depression. One of the well established theory is the Monoamine Neurotransmitter Dysfunction. Recent studies has come up with several other factors like:[3]

a) Neurotrophins
b) miRNA

Corresponding author: Nidhi Jain

c) Stress Hormones
d) Inflammation
e) Gut Microbiota
f) Adult Neurogenesis

Adult Neurogenesis is sustained by subgranular zone of the hippocampal dentate gyrus & subventricular zone of the lateral ventricles.[3] Chronic stress leads to impaired HPA axis causing increase in glucocorticoids which alters 3 area:[3]

a) mPFC
b) Hippocampus
c) Amygdala

The interplay of these factors leads to reduction in hippocampal volume which is responsible for difficulties in executive functioning like problem in planning, organising, information processing speed, working memory.[2]

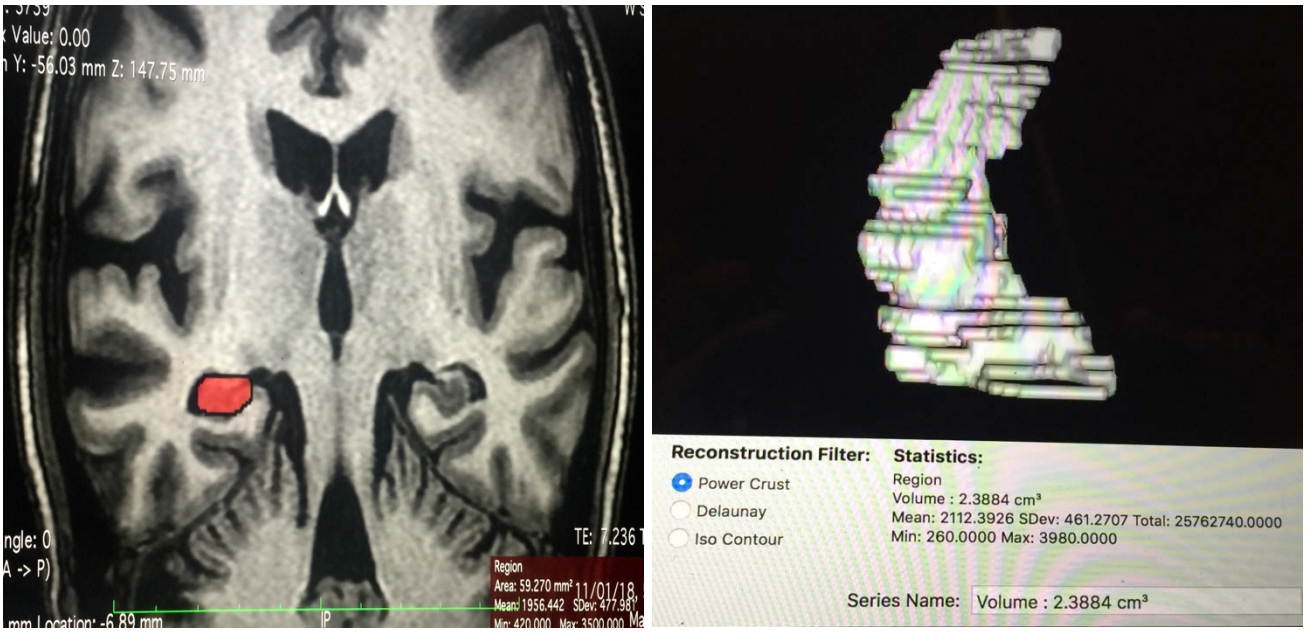
The purpose of this study is to evaluate the correlation of increasing severity and duration of depression with hippocampal volume.

MATERIAL AND METHODS:

The study has been conducted in Department of Psychiatry in collaboration with Department of Radiodiagnosis, R D Gardi Medical College, Ujjain. It comprised of 60 patients with the inclusion criteria of ages 18-65, fulfilling the DSM-5 criteria for Major Depressive Disorder and willing to consent for the study. Exclusion criteria were patients having any organic lesion detected on MRI Brain, with previous history of other psychiatric illness, history of any serious physical illness. They were interviewed using HAM-D Scale Questionnaire, who then had MRI Brain with a 3D IR-PREP sequence.

RADIOLOGICAL EVALUATION:

The data was obtained using 1.5 Tesla, GE MRI scanner. A coronal 3D IR-PREP(Inversion Recovery) sequence was obtained. In the coronal plane, with the help of HOROS Software volume is calculated using white matter from the parahippocampal gyrus serving as the inferior boundary and white matter from the alveus as the superior boundary. The gray matter of the pes hippocampus is situated between these two boundaries. In the coronal plane the most anterior hippocampal slice should outline into a triangular gray area (pes hippocampi), which enlarges as one moves posteriorly.



Relevant data according to the aforementioned tests was collected for the individual case. The data was pooled, tabulated and subjected to statistical analysis.

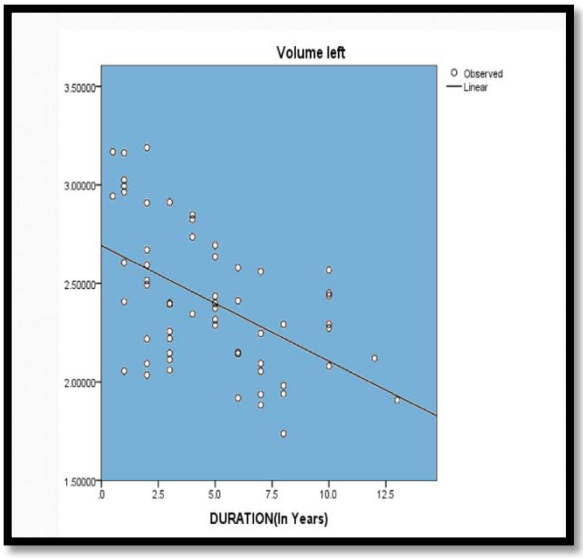
RESULTS:

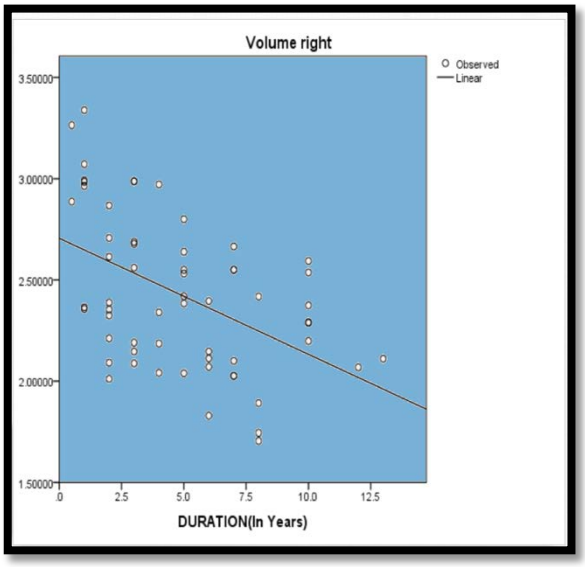
The depressive patients had a significant correlation with Hippocampal Volume which is observed on the both sides and its inversely related to increasing duration and severity.

The correlation of Hippocampal Volume with Duration is significant at; For the Right Side (beta=-0.57,p<0.00, R^2= 0.231) and For the Left Side (beta=-0.05, p<0.00, R^2 =0.268).

The correlation of Hippocampal Volume with Severity is significant at; Right Side(beta=-0.038, p<0.002,R^2 =0.155) and for the Left Side (beta=-0.26, p<0.029, R^2 =0.08)

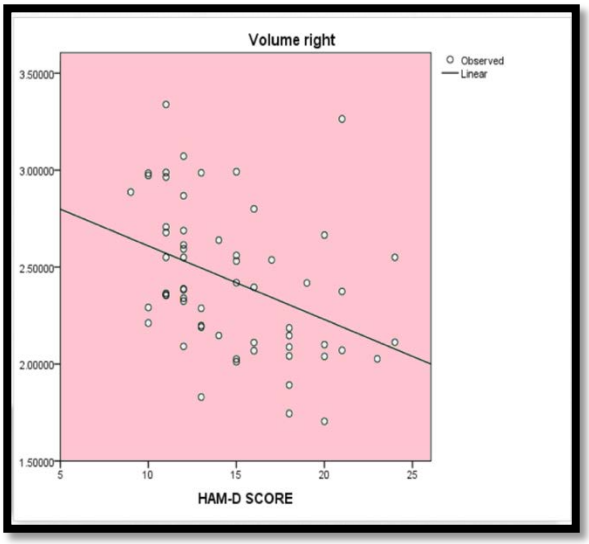
CORRELATION OF VOLUME WITH DURATION



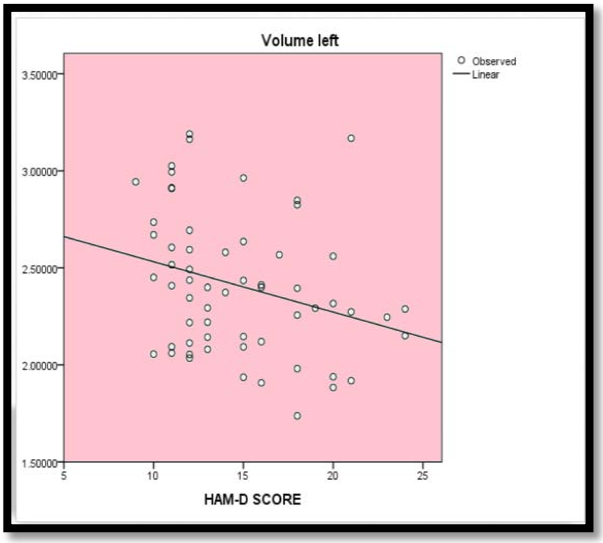


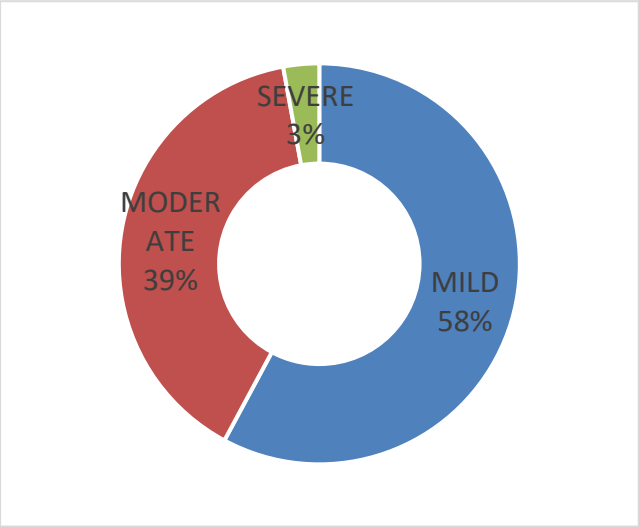
CORRELATION OF VOLUME WITH SEVERITY

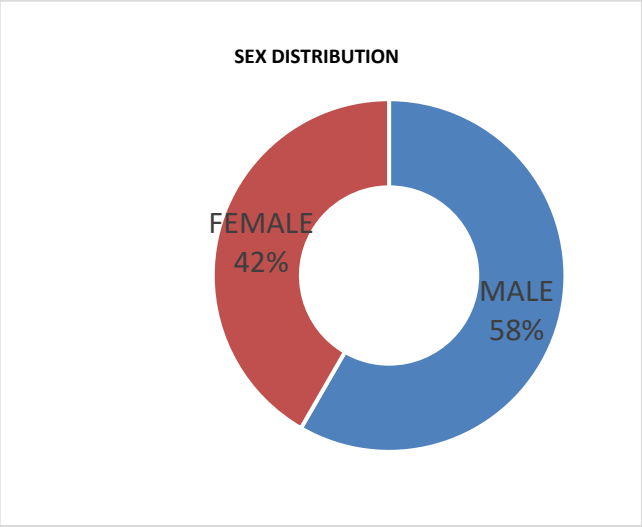
GENDER DISTRIBUTION



HAM-D SCORE







The reduction in volume is more on the Right Side as compared to Left Side. There was no significant difference between gender.

DISCUSSION:

The principal finding of this study is significant inverse relation of hippocampal volume with duration of illness and severity which denotes the involvement of hippocampus in the pathogenesis of depression. The previous studies have also reported significant correlation, some with result indicating more reduction on Left Side than the Right Side.[4] Clinical studies have shown that there is a well established link between volume reduction and hypercortisolemia in stress and depression causing structural changes in hippocampus and in the gross structrues in brain.[5] Structural changes to the hippocampus might be due to remodeling of key cellular elements, involving retraction of dendrites, decreased neurogenesis in the dentate gyrus, and loss of glial cells.[6] There are studies supporting the evidence that pharmacological treatment with anti-depressants and also with ElectroConvulsive Therapy an increase in volume has been found.[5]

CONCLUSION:

From this study it could be concluded that there is a significant role of hippocampus in the pathophysiology of depression. There is an inverse correlation of hippocampal volume with increasing duration of illness and severity of illness. Treatment with antidepressants and ECT will help in increase in hippocampal volume along with remission of symptoms.

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