



COMPARISON OF QUANTITATIVE AND QUALITATIVE ASSESSMENT OF MRI IN DIAGNOSING HIPOCAMPAL ATROPHY AMONG CASES OF TEMPORAL EPILEPSY.

Abdul Raouf¹, Saba Jehangir², Asma Shaukat³, Muhammad Ahsan⁴

1. MBBS, FCPS, FRCP
Fellowship of Intervention Radiology
(AKU, Karachi)
Senior Registrar
Allied Hospital, Faisalabad.
2. MBBS
Medical Officer
Madinah Teaching Hospital,
Faisalabad.
3. MBBS
Medical Officer
Allied Hospital, Faisalabad
4. MBBS
Medical Officer
Allied Hospital, Faisalabad

Correspondence Address:
Dr. Muhammad Ahsan
Allied Hospital, Faisalabad.
ahsanjahangir194@gmail.com

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ABSTRACT... Mesial temporal sclerosis (MTS) is the most common pathology in patients undergoing anterior temporal lobectomy. Magnetic resonance imaging (MRI) is valuable in detecting MTS. Reduced hippocampal volume and elevated T2 signal are associated with MTS, and both quantitative T2 and volumetric measurements have been associated with hippocampal cellular loss that characterizes this condition. **Objectives:** To determine the accuracy of hippocampal quantitative (T2 relaxometric) assessment in diagnosing hippocampal atrophy in patients with temporal lobe epilepsy by comparing it with qualitative (visual) assessment on MRI. **Study Design:** Cross sectional study. **Setting:** Radiology department of Allied Hospital Faisalabad. **Period:** 12 months from the approval from Sep, 2016 to Dec, 2017. **Subjects & Methods:** After taking permission from hospital ethical committee, and written informed consent, patients with history of temporal lobe epilepsy and EEG findings consistent with temporal lobe epilepsy were examined on 1.5 Tesla Achieva philips scanner, visual assessment and T2 relaxometry. Section of the hippocampus head was defined as the first in which it was possible to see the temporal horn of the lateral ventricle and therefore to appropriately separate the hippocampal formation from the amygdala. The body of the hippocampus defined in the fourth coronal section after the region of interest of the hippocampus head, and the tail was defined in the third coronal section after the hippocampus body, in which it is also possible to visualize the quadrigeminal plate (section of 5mm). Visually the images were assessed and MRI examination was done. All the data was collected on a performa. **Results:** We concluded that the frequency of accuracy of hippocampal quantitative (t2 relaxometric) assessment in diagnosing hippocampal atrophy in patients with temporal lobe epilepsy by comparing it with qualitative (visual) assessment on MRI is high but needs validation through some-other studies. **Conclusion:** We concluded that the frequency of accuracy of hippocampal quantitative (t2 relaxometric) assessment in diagnosing hippocampal atrophy in patients with temporal lobe epilepsy by comparing it with qualitative (visual) assessment on MRI is high but needs validation through some-other studies.

Key words: Accuracy, Body, Head, Hippocampus, Hippocampal Quantitative (T2 Relaxometric), Temporal Lobe Epilepsy, Tail.

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INTRODUCTION

Epilepsy is one of the chronic diseases of CNS with an enduring predisposition to generate spontaneous epileptic seizures. According to an estimate, about 3 million people in United States are affected by epilepsy and has become one of the most prevalent CNS disorder. Worldwide, an estimated 50 million individuals are affected by epilepsy, which accounts for an overall 1% burden¹ with mesial temporal lobe epilepsy

(MTLE) being more prevalent among adults² and in those with intractable temporal lobe epilepsy.³

Hippocampal sclerosis (HS) is the main cause of TLE, and up to 65% of cases of TLE can be attributed to pathology arising entirely in the hippocampus.³ Magnetic resonance imaging (MRI) is the ideal investigation for diagnosis of anatomical cause of epilepsy and to look for any associated pathologies and to plan any procedure

to control refractory cases.

According to the guidelines of United Kingdom, MRI must be done; only exception are children and young adults with generalized epilepsy of no known cause and those showed no improvement after medical therapy (National Institute for Health and Clinical Excellence, 2012).⁴ With the widespread use of high-resolution MRI with epilepsy protocols over the last two decades, our ability to visualize subtle structural changes has been greatly enhanced.⁵ Visual (qualitative) assessment of T2-weighted changes (hyper intense signals and atrophy) is one of the earliest methods which showed association between hippocampal pathology and abnormality identified on MRI. T2 relaxometry is a quantitative technique to determine the prevalence and status of T2 abnormality.³ Carr-Purcell-Meiboom-Gill sequence was used to see the T2 relaxation times.³

Comparison of Hippocampal T2 maps from healthy and epileptic individuals shows the prolonged T2 of the HS patients.⁶ Hippocampal sclerosis was detected by visual assessment and T2 relaxometry in 62% of patients (according to research carried out by Paradeep Singh, Rupinderjeet Kaur, Kavita Sagggar, Gagandeep Singh, and Amarpreet Kaur at Bio Med Research International).³

This Study is carried out to see how accurately different MRI imaging modalities detect hippocampal sclerosis and quantify disease progression with special benefit to patients who have medically refractory epilepsy and are potential candidates for surgical cure of their illness. Since no similar study has been carried out in Pakistan it is essential that such a study is initiated to benefit patients with both medically treated and medically refractory Epilepsy with better diagnosis and help patient management and prognosis in future.

MATERIAL AND METHODS

This cross sectional study was conducted after taking permission from hospital ethical committee patients were collected from OPD of Radiology

Department, Allied hospital Faisalabad. Written Informed consent was taken after explaining the objective & procedure of the study. Patients of age 10-60 years of both sexes having temporal lobe epilepsy on the basis of history and /Or EEG findings were included in the study.

Diagnosed cases of temporal lobe epilepsy confirmed by listening to how they describe their seizures or hearing observations of a witness. Features that were looked for (any one or in combination) are abnormal sensations i.e déjà vu (familiar feeling regarding an incident), jamais vu (unfamiliar feeling or sensation regarding an incident), auditory sensation (an unusual sound or noise), gustatory sensation (an unusual flavor), olfactory (an unusual smell), visual, sensory (presence of something on skin or in the internal organs) and amnesia or resurfacing of old memories and or EEG showing specific 5–7 Hz discharging waves during seizures and ipsilateral anterior /mid temporal inter-ictal spikes or sharp waves suggested the diagnosis. (all above features are for temporal lobe epilepsy).

T2 relaxometry was defined as mapping which provides a quantitative mean for assessment of hippocampal sclerosis. T2 relaxation time of hippocampus ranges from 99 to 106 msec (>116 msec was considered MRI evidence of hippocampal sclerosis). Visual assessment was the assessment of images qualitatively for hippocampal atrophy, loss of defined morphologic structure of hippocampus, the asymmetry between the two hippocampi. and subjective increase in T2 signals and decreased T1 signals. (dark hyper intense as compare to other side). True positives was defined as cases that had hippocampal atrophy both on visual and T2 relaxometric assessment. True negatives were defined as cases that was not hippocampal atrophy on visual and T2 relaxometric assessment. Patients having history of implanted metallic pacemakers and patients having with claustrophobia were not included in the study.

Sample size of 95 by using the WHO sample size calculator having P=62% and Confidence level of 95% with absolute precision requirement

of 10%. Sample collection done through non-probability consecutive sampling. The patients were examined on Achievaphilips scanner; visual assessment and T2 relaxometry was calculated using 8-echo Carr-Purcell-Meiboom-Gill sequence. Images were taken from the oblique coronal slice from 22ms to 352ms and along with T2 maps. T2 relaxation time was noted after calculation along with the mean hippocampal T2 relaxation time. Some ROIs were marked as hippocampal head, body, and tail; area with temporal horn of lateral ventricle was labeled as head, body was taken in the 4th coronal section and tail in the third coronal section. Visually the images were assessed as per operational definition. The MRI examination was carried out by a senior technician under supervision. The data was collected on a performa.

All the data was analyzed by using SPSS V-16. Mean and standard deviation was for variables like age and frequency/percentage was calculated for gender and true positive. Effect modifiers like age and gender were controlled through stratification and post-stratification chi-square test applied with p-value of < 0.05 taken as significant.

RESULTS

Almost 95 cases meeting criteria were included to determine the accuracy of hippocampal quantitative (T2 relaxometric) assessment in diagnosing hippocampal atrophy in TLE patients by comparing it with qualitative (visual) assessment on MRI. Age distribution and gender is shown in the Table-I and II. Frequency of accuracy of hippocampal quantitative (T2 relaxometric) assessment in diagnosing hippocampal atrophy in patients with TLE by comparing it with qualitative (visual) assessment on MRI was recorded as 72.63% (n=69) while 27.37% (n=26) were not diagnosed accurately. (Table-III).

| Age (in Years) | No. of Patients | % |
|----------------|-----------------|-------|
| 10-30 | 41 | 43.16 |
| 31-60 | 54 | 56.84 |
| Total | 95 | 100 |
| Mean+SD | 34.27+9.16 | |

Table-I. Age distribution (n=95)

| Gender | No. of Patients | % |
|--------|-----------------|-------|
| Male | 49 | 51.58 |
| Female | 46 | 48.42 |
| Total | 95 | 100 |

Table-II. Gender distribution (n=95)

| Accuracy | No. of Patients | % |
|----------|-----------------|-------|
| Yes | 69 | 72.63 |
| No | 26 | 27.37 |
| Total | 95 | 100 |

Table-III. Frequency of accuracy of hippocampal quantitative (T2 relaxometric) assessment in diagnosing hippocampal atrophy in patients with temporal lobe epilepsy by comparing it with qualitative (visual) assessment on MRI (n=95)

Effect modifiers like age and gender were calculated by stratification. Post stratification chi-square test was applied. P-value<0.05 was taken as significant. (Table-IV&V).

| Age (in Years) | Hippocampal atrophy in patients with temporal lobe epilepsy | | P-Value |
|----------------|---|----|---------|
| | Yes | No | |
| 10-30 | 32 | 9 | 0.30 |
| 31-60 | 37 | 17 | |

Table-IV. Stratification for frequency of accuracy with regards to age (n=95)

| Age (in Years) | Hippocampal atrophy in patients with temporal lobe epilepsy | | P-Value |
|----------------|---|----|---------|
| | Yes | No | |
| Male | 35 | 14 | 0.78 |
| Female | 34 | 12 | |

Table-V. Stratification for frequency of accuracy with regards to gender (n=95)

DISCUSSION

Patients with mesial temporal sclerosis (MTS) end up in a procedure called anterior temporal lobectomy. MRI is ideal for the detection of MTS. MRI showing decrease in size of hippocampus and increased T2 signal is significantly associated with MTS; both these are further due to loss of cells in the hippocampus.

This Study was carried out to see how accurately different MRI imaging modalities detect

hippocampal sclerosis and quantify disease progression with special benefit to patients who have medically refractory epilepsy and are potential candidates for surgical cure of their illness. Since no similar study has been carried out in Pakistan it is essential that such a study is initiated to benefit patients with both medically treated and medically refractory Epilepsy with better diagnosis and help patient management and prognosis in future.

In this study, out of 95 cases, 43.16% (n=41) were between 10-30 years of age while 56.84% (n=54) were between 31-60 years of age, mean +SD was calculated as 34.27+9.16 years, 51.58% (n=49) were male and 48.42% (n=46) were females. Frequency of accuracy of hippocampal quantitative (T2relaxometric) assessment in diagnosing hippocampal atrophy in TLE cases by comparing it with qualitative (visual) assessment on MRI was recorded as 72.63% (n=69).

Singh P, and others are of the view that hippocampal sclerosis was detected by visual assessment and T2 relaxometry in 62% of patients.³ Wehner et al⁷ investigated patients with MTLE and concluded that the apparent diffusion coefficients did not provide any lateralizing information without any evidence of hippocampal sclerosis at MR imaging performed with a standard temporal lobe protocol.

Capizzano et al⁸ reported that, by using only hippocampal data with proton MR spectroscopy, 60% of cases of MTLE were correctly lateralized; this MR spectroscopy result is lower than the sensitivity of the finding of PLHS. Jackson et al.⁹ concluded that about 15% cases with hippocampal sclerosis showed hippocampus volumes within normal range on MRI.

Cohen-Gadol et al¹⁰ designated the group of patients whose features and labs favor MTLE and MR imaging had no signal intensity abnormality at hippocampus as having paradoxical temporal lobe epilepsy (PTLE). In their evaluation, loss of pyramidal cells in the CA1 region was significantly slighter for PTLE than for typical hippocampal sclerosis. The cases showing only PLHS as an

abnormal finding in our study might coincide with the cases of PTLE described by Cohen-Gadol et al. Since no similar study has been carried out in Pakistan it is essential to conduct some other studies to validate our results.

CONCLUSION

We concluded that the frequency of accuracy of hippocampal quantitative (T2 relaxometric) assessment in diagnosing hippocampal atrophy in cases with TLP by comparing it with qualitative (visual) assessment on MRI is high but needs validation through some-other studies

CONFLICT OF INTEREST

None of the authors have declared any conflict of interest.

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AUTHORSHIP AND CONTRIBUTION DECLARATION

| Sr. # | Author-s Full Name | Contribution to the paper | Author=s Signature |
|-------|--------------------|----------------------------------|---|
| 1 | Abdul Raouf | Data collection. |  |
| 2 | Saba Jehangir | Data collection. | |
| 3 | Asma Shaukat | Data analysis & Data collection. | |
| 4 | Muhammad Ahsan | Paper writing & Data analysis. | |