Original Article

Evaluation of bilateral hippocampi using T2 Relaxometry values in epileptic and non epileptic patients

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Abstract

Introduction: The use of magnetic resonance imaging (MRI) as a quantitative tool has attracted great interest by various research centers. The improvement in the sensitivity and reduction of the subjectivity of visual evaluation created a significant impact on the diagnosis of tissue abnormalities. **Aims and Objective:** Evaluation of bilateral hippocampi using T2 Relaxometry value in epileptic and non-epileptic patients. **Methodology:** This was a Prospective study of 6 months duration (May 2013 - October 2013) at Sri Ramachandra Medical College, Department of Radiology and Imaging Sciences in A population of 30 patients of either sex who presented themselves in Radiology department whose reports and image data's are collected prospectively during the study period. The majority of the Patients were Female i.e. 53.3 %, followed by Male 46.7%. Out of the total 30 patients, 10 (33%) were patients of epilepsy and 20 (67%) were Non –epileptic patients. **Result:** The range of measured T2 relaxation values from 20 control / non epileptic subjects was 88.2 - 117.2 ms with a mean of 101.57 ms and standard deviation (SD) of 6.87 on the right hippocampi and the range of measured T2 relaxation value on the same on left side hippocampi was 91 - 119 ms with a mean of 100.72 ms and standard deviation of 6.86. **Conclusion:** It is observed that T2 relaxometry values in both the Right and left hippocampus were increased in the Epileptic patients.

Key Words: T2-Relaxometry, Epilepsy, Bilateral hippocampus.

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Received Date: 10/01/2017 Revised Date: 27/02/2017 Accepted Date: 12/03/2017

Access this article online	
Quick Response Code:	Website: www.medpulse.in
	DOI: 15 March 2017

INTRODUCTION

The use of magnetic resonance imaging (MRI) as a quantitative tool has attracted great interest by various research centers. The improvement in the sensitivity and reduction of the subjectivity of visual evaluation created a significant impact on the diagnosis of tissue abnormalities. The most common MRI techniques for quantitative diagnosis at the lesion level are Relaxometry (R), Magnetization Transfer (MT) and Spectroscopy (MRS). However, one important issue is standardizing a calibrating protocol to be used in different scanners that is imperative to allow the use of MRI as a quantitative tool. Epilepsy is a familiar neurological disease characterized by recurrent seizures. Even though epilepsy is presently generally well manageable with modern antiepileptic drugs, there still remain about 30% of patients with epilepsy who do not respond to optimal treatment[1]. These patients are then understood to have intractable or medically refractory epilepsy. Most of the patients have had good outcomes after surgery, and this regularly depends on the presurgical evaluation by EEG and magnetic resonance imaging (MRI). Unilateral hippocampal sclerosis (HS) is the most frequent pathological finding in temporal lobe epilepsy (TLE), and up to 65% of cases of TLE can be attributed to pathology arising entirely in the hippocampus[2]. Visual (qualitative)

How to site this article: Arunan Murali, Bhasker Raj T, Venkatasai P M, Suhail V, Sheila Elangovan. Evaluation of bilateral hippocampi using T2 Relaxometry values in epileptic and non epileptic patients. *MedPulse – International Medical Journal.* March 2017; 4(3): 336-339. http://www.medpulse.in (accessed 16 March 2017).

assessment of T2-weighted changes (hyperintense signal on T2-weighted images and atrophy) was the earliest method that demonstrated an association among hippocampal pathology and MR-detectable signal abnormality. Hippocampal volume loss is a sensitive and specific pointer of hippocampal sclerosis in the clinical setting of epilepsy, and hippocampal volumetric study can quantify atrophy in TLE patients. T2 relaxometry is another quantitative technique to determine the frequency and severity of T2 abnormality. Hippocampal T2 relaxation time increases in patient of hippocampal sclerosis[3]. Mesial temporal sclerosis (MTS) is the most common known pathologic substrate of epilepsy. Tissue hydration is quantified via T2 relaxometry[4] and hippocampal atrophy is quantified via hippocampal volumetry[5]. The most common radiologic manifestation of MTS seen in clinical practice is a unilateral atrophic hippocampus with increased signal, with a normal-appearing contralateral hippocampus. The surgical approach to temporal lobe epilepsy (temporal lobectomy) is also driven by the concept that MTS is a unilateral phenomenon. However, autopsy studies and, more recently, quantitative MR studies (volumetry and T2 relaxometry) indicate that MTS is present bilaterally in a substantial percentage of patients with temporal lobe–onset seizures[3,4,6]. For the sake of illustration, the entire spectrum of MTS can be divided into four possible conceptual categories[6]: (a) unilateral hippocampal damage, in which MTS is present unilaterally, and the contralateral hippocampus is completely normal, (b) bilaterally asymmetric damage, in which MTS is present bilaterally, but is more severely represented on one side, (c) bilaterally symmetric damage, in which MTS is present and of equivalent magnitude in both hippocampi, and (d) symmetric normal hippocampi, in which neither hippocampus has changes of MTS. This fourth category is conceptually useful in the context of this discussion, because distinguishing mild MTS from a normal hippocampus is often not straightforward, either with MR imaging or with qualitative pathologic analysis. These four groups represent conceptual points along a continuous distribution of hippocampal damage ranging from normal to severe MTS in one or both hippocampi[6]. Most cases of MTS encountered for presurgical evaluation in general clinical practice will have hippocampal atrophy, increased signal, or, more commonly, both[7–11]. The accuracy of visual inspection of an appropriately. Performed MR examination in the setting of clear unilateral MTS exceeds 90%. A recent evaluation of fluid-attenuated inversion-recovery imaging sequences showed an accuracy of 97% with pathologic determination of MTS as the standard of reference[12]. Quantitative MR techniques (relaxometry and volumetry) are useful in assessing bilaterality, and also in assessing the continuous distribution of damage from severe to mild to none, are well positioned to address these issues[5,13–15].

MATERIAL AND METHODS

This was a Prospective study of 6 months duration (May 2013 - October 2013) at Sri Ramachandra Medical College, Department of Radiology and Imaging Sciences in A population of 30 patients of either sex who presented themselves in Radiology department whose reports and image data's were collected prospectively during the study period. A detailed history with various patient's data which includes patient demographic details, hospital ID, and study reports are collected and entered in a specially designed Proforma. MR imaging was performed on 1.5- Tesla MRI scanner (Magnetom Avanto, 18 channels, Siemens Medical Solutions, Erlangen, Germany) with a matrix head coil used as both transmitter and receiver. T1W, T2W, diffusion-weighted, and HEMO sequences were obtained in axial plane with 5mm slice thickness and 30% interslice gap. For dedicated hippocampal study, inversion recovery (IR) oblique coronal images and oblique coronal T2W images (TR 5470, TE: 90, FOV: 200, slice thickness 2 mm) covering the whole brain were acquired. Oblique coronal plane was perpendicular to the long axis of hippocampus. The images were assessed for hippocampal atrophy, loss of defined morphologic structure of hippocampus, increased T2W signal and decreased T1W signal and a T2 relaxometry sequence is done to assess the T2 relaxation time of hippocampus using 16 - echo sequence. All the patients' data within the study period were collected. Patients were selected irrespective of their age group, gender and pathologic findings excluded from the study. T2 relaxometry values of the bilateral hippocampus for all the 30 patients were collected and analyzed.

RESULT

Table 1: Gender Wise Distribution of Patients for the study

Sex	No. Of patients	Percentage (%)
Male	14	46.7
Female	16	53.3
Total	**30**	**100**

The majority of the Patients were Female i.e. 53.3 % followed by Male 46.7%

Table 2: History / Cause Wise Distribution of Patients for the study

History	No. Of patients	Percentage (%)
Epilepsy	10	33
Non-Epilepsy	20	67
Total	30	100%

Out of the total 30 patients 10 (33%) were patients of epilepsy and 20 (67%) were Non –epileptic patients.

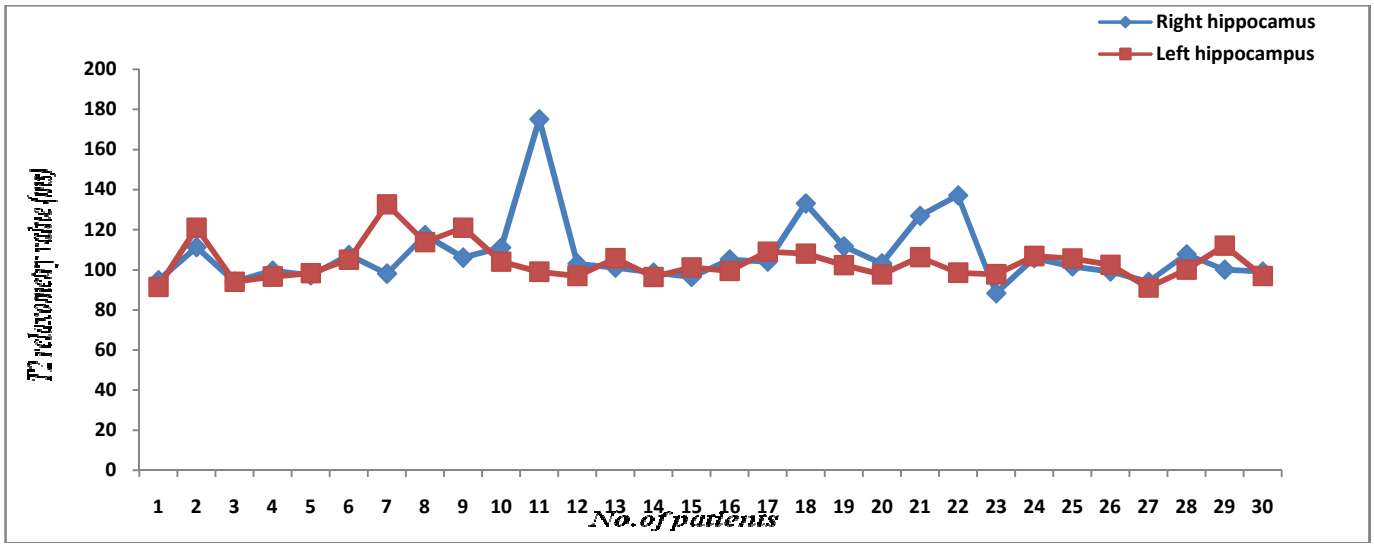

Table 3: T2 relaxometry values of the Right and left hippocampus

No. of patient	RT T2	LT T2
1	94.7	91.4
2	111.2	119
3	94	93.9
4	99.5	96.6
5	97.2	98.3
6	107.3	105
7	98	132.6
8	117.2	113.8
9	106	121
10	111	104
11	175	91
12	102.9	96.9
13	101	105.7
14	98.5	96.3
15	96.4	101.1
16	105	99.4
17	104	109
18	133	108
19	111.6	102.3
20	103.1	97.6
21	126.8	106.2
22	137	98.5
23	88.2	97.7
24	105.8	106.8
25	101.6	105.6
26	99.1	102.4
27	93.9	91.1
28	107.6	100
29	100	112
30	99	96.8

*(No. of patients with T2-relaxometry values are presented and the Epileptic patients are shown by Bold letters. i.e. Pt. Nos. : →7, 8,9,10, 11, 18, 21, 22, 25, and 29) In Table 3: It can be seen that T2 relaxometry values in both the Right and left hippocampus are increased in the Epileptic patients.

DISCUSSION

T2 relaxometry is a quantitative magnetic resonance tool that can be used to increase the sensitivity of identifying hippocampal abnormalities above that of visual assessment alone.T2 Relaxometry of hippocampus study was done on a population of 30 patients who presented themselves in Radiology department. Of these 10 patients had the history of seizures / epilepsy and 20 patients who had no symptoms of seizures or epilepsy were chosen as control volunteers. The range of measured T2 relaxation values from 20 control / non epileptic subjects was 88.2 - 117.2 ms with a mean of 101.57 ms and standard deviation (SD) of 6.87 on the right hippocampi and the range of measured T2 relaxation value on the same on left side hippocampi was 91 - 119 ms with a mean of 100.72 ms and standard deviation of 6.86. T2 relaxation times were calculated using 16-echo Carr-Purcell-Meiboom-Gill sequence which is basically a multiple spin-echo sequence.

CONCLUSION

It is observed that T2 relaxometry values in both the Right and left hippocampus were increased in the Epileptic patients.

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Source of Support: None Declared
Conflict of Interest: None Declared