CORRELATION OF METABOLIC ALTERATION IN MAGNETIC RESONANCE SPECTROSCOPY WITH EEG IN DIAGNOSIS OF CHILDHOOD EPILEPSY

By

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ABSTRACT

Background*: Epilepsy is a heterogonous group of disorders with multiple causes. It is a common neurologic condition worldwide. Up to 8% of the population will experience at least once seizure in their lifetime.*

Objective*s: The purpose of this study was to evaluate the potential benefits of MR Spectroscopic image in lateralization of epileptic foci in correlation with EEG and clinical features in the patients with epilepsy.*

Methodology: *Between December 2016 and August 2018, a total of 50 patients (28 male &22 female) having seizures were selected from the Neurology unite, Pediatric Department, Sayed Galal Hospital, Al Azhar University, underwent to routine video EEG& MRS examination.*

Results: *36 patients (72% of total patient number) were found to have abnormal MRS finding. Seven patients (14%) have abnormal finding in both sides. 12 patients (24%) had abnormal data on right side. 17 patient (34%) had abnormal finding on left side. EEG was positive in 34 cases (68%), 14 case (28%) had bilateral findings;12 case (24%) had left sided and 8 cases (16%)had rt sided EEG findings. The temporal region was the commonest epileptogenic area in EEG&MRS. MRS sensitivity to EEG was (79.4%) and specificity was (43.75%) results were nearly consistent with EEG especially in cases with focal EEG discharges.*

Conclusion: *MRS is a very sensitive noninvasive guiding tool in predicting the lateralization related epilepsy mainly temporal lobe epilepsy rather than generalized epilepsy. It helps in detecting abnormal spectra of various brain metabolites before appearance of structural lesions.*

Recommendation: *MRS is a very sensitive noninvasive guiding tool in predicting the lateralization related epilepsy mainly temporal lobe epilepsy rather than generalized*

epilepsy. It helps in detecting abnormal spectra of various brain metabolites before appearance of structural lesions.

Key words; *MRS; Epilepsy; EEG*

INTRODUCTION

Epilepsy is a heterogonous group of disorders with multiple causes. It is a common neurologic condition worldwide. Up to 8% of the population will experience at least once seizure in their life time. An epileptic seizure is a clinical manifestation of abnormal excessive neuronal activity arising in the grey matter of the cerebral cortex. The disorganized neuronal activity may be a purely electro-physiological event resulting in no clinically evident seizures, or it can lead to seizure specifically related to the site of activity or to some secondary activated site distant from the original source(1).

Seizures are the most common pediatric neurological disorder with 4% to 10 % of children suffering at least one seizure in the first 16 years of life. The incidence is highest in children younger than 3years of age, with decreasing frequency in older children. Epidemiological study reveals that approximately 150,000 children will sustain a first time unprovoked seizure each year, and of those 30,000 will develop epilepsy (2).

Epilepsy is suspected when there is repetition of seizures or an unprovoked seizure is accompanied by a probability of further seizures similar to the general recurrence risk after two unprovoked seizures(3).

Temporal lobe seizurers are the most common type of partial epilepsy. Temporal lobe seizures often begin with an aura. Auras may include viscera sensory symptoms (epigastric sensation, thoracic sensation, and worm ascending sensation) or sensory elusions or hallucinations. Hand automatism are repetitive, purposeless movement of the hand including grasping and searching movement .Both oroalimentary and hand movement often localize to mesial temporal lobe(4).

EEG continues to play a central role in diagnosis and management of patients with seizure disorders in conjunction with the remarkable variety of other diagnostic techniques developed over the last 30 years because it is a convenient and relatively inexpensive way to demonstrate the physiological manifestations of abnormal

cortical excitability that underlie epilepsy[5].

Magnetic Resonance Spectroscopy (MRS) is an analytical method used in chemistry that enables the identification and quantification of metabolites in samples. It differs from conventional Magnetic resonance Imaging (MRI) in that spectra provide physiological and chemical information instead of anatomy. MRS is a noninvasive technique capable of providing metabolic information about different tissues; also it enables tissue characterization on a biochemical level surpassing that of conventional magnetic resonance imaging (cMRI). It detects abnormalities that are invisible to cMRI because metabolic abnormalities often precede structural changes[6].

Levels of EEG diagnosis of epilepsy &epileptic syndromes: graded, from highest to lowest, into the following levels:

A) Confirmatory of clinical diagnosis. The EEG contains:
   1) Typical seizure(s).
   2) Typical interictal epileptic activity.
   3) No atypical features.

B) High diagnostic certainty (probable): No seizure is recorded, but the EEG contains:
   i) Typical inter ictal epileptic activity.
   ii) No atypical features.

C) Lower diagnostic certainty (possible): When no seizure is recorded, but the EEG contains:
   i) Typical interictal epileptic activity and
   ii) Some atypical features[8].

PATIENT AND METHODS

Patients population: This a prospective, uncontrolled, single armed and unblind study was conducted between December 2016 and August 2018, a total of 50 patients (29 patient male &29 patient female) having generalized were selected from the Neurology unit, pediatric department, Sayed Galal Hospital, Al Azhar University and were studied in this work. All legible patients were underwent to: History& clinical examination, Inter ictal Scalp routine video EEG recording and Magnetic resonance spectroscopy analysis using multi voxel mode.

Inclusion criteria:

All patients with idiopathic epilepsy with their age range from 3months till 15 years old.

Exclusion criteria:

1. Patients with encephalopathy as (metabolic or infectious causes) excluded by normal metabolic screening or organic brain lesions as hemorrhage and tumors (lesional epilepsy).
2. Patient with symptomatic or cryptogenic epilepsy.

Patient preparation for MRI

The patients were asked to remove any ferromagnetic metals (such as coins and pins). Pacemaker and any ferromagnetic fixating crews or plate were excluded from this examination. All patients and their parents were informed about the MRI magnets, approximate duration of MRI and MRS techniques and were instructed not to move during the examination time. The patients were seizure free in last 48 hours.

MR imaging and spectroscopy techniques

Patient positioning and preparation for scanning. Patients were positioned on the MRI examination table in the supine position. The MRI and MRS examinations were performed in all patients in one session. They were performed at 1.5 T super conducting system (Philips Achieve MRI machine) manufactured at 2009, the Netherlands. The MRI and 1H MR spectroscopy were performed without sedation in older children; choloral hydrate & Midazolam were used in younger children.

Scan setup and scan parameters. The spectra were acquired in conjunction with an MR imaging study of the brain that included 3-mm coronal T2 spin-echo (SE) images, 3-mm coronal flair images, 3-mm coronal inversion recovery images through the temporal lobes, and 5-mm axial T1 and T2 SE images through the entire brain. During the time of scanning, patients are seizure free for at least 3 days. To obtain MRS technique, scout imaging of the brain in coronal and sagittal orientations was performed with T1 WI (Repetition time ms/Echo time ms 500/14, section thickness 3 mm) angulation parallel to the long axis of the hippocampus for localization of the transverse plane. In addition, an oblique transverse T2 WI (Repetition time ms/Echo time ms 2550/80, section thickness 3 mm) was also acquired along the optical nerve. The MRS was performed using single &multi voxel, point-resolved spectroscopy (PRESS) technique. The size of the volume was mostly 10 _ 20 _ 10 mm3 (left-to-right, anteroposterior, and feet-to-head directions). The box of volume of interest (VOI) was positioned

parallel to the axis of the hippocampus, the hippocampal region and adjacent mesial temporal lobes were covered. Contact with the cerebrospinal fluid and the temporal bone was avoided.

EEG recording: Using '10-20 system of international electrode placement'. A specific scalp electrode is denoted by an alphabet followed by a number. The alphabet refers to the location (F –frontal, C-central, P- parietal, T- temporal, O- occipital). The number represents the side (odd number for left and even number for right) as well as anteroposterior or superoinferior location (1 is anterior to 3). F3 represent a left frontal electrode, which is superior (location; not quality) to F7. The landmarks are bilateral pre-auricular points and, nasion and inion (occipital). Electrodes are spaced either 10% or 20% of the total distance between a pair of landmarks.

Activation procedures:

1. Hyperventilation: In some kids of epilepsy you can precipitate an absence seizure by hyperventilation.
   Hyperventilation is generally done for a period of 3 minutes.
2. Photic stimulation: A series of light flashes at different frequencies (1- 30 Hz) are shown to the child for 5-10 seconds. It is interesting to note that the occipital electrodes can show the same frequency as the flash frequency during photic stimulation. This is a normal finding (photic driving).
3. Sleep depreviation.

According to the EEG results the patients were classified to 3 groups:

Group 1: patients with normal EEG.

Group 2: patients with focal EEG abnormalities.

Group 3: patients with generalized EEG abnormalities.

RESULTS

Table (1): Comparison between the different studied groups according to demographic data

	Group 1 (n = 16)		Group 2 (n = 20)		Group 3 (n = 14)		Test of Sig.	P	Sig.
	No.	%	No.	%	No.	%			
Sex									
Male	12	75.0	10	50.0	7	50.0	c^2= 2.791	0.248	NS
Female	4	25.0	10	50.0	7	50.0			
Age (years)									
Min. – Max.	0.41 – 10.0		3.0 – 13.0		0.25 – 13.0		F= 1.472	0.240	NS
Mean ± SD.	5.41 ± 3.91		7.35 ± 2.94		6.05 ± 3.61				

X^2: Chi square test F: F for ANOVA test.

P: p value for comparing between the studied groups

Group 1: patients with normal EEG.

Group 2: patients with focal EEG abnormalities

Group 3: patients with generalized EEG abnormalities

No statistical significant difference between studied cases as regard the age &sex.

Table (2): Base line clinical data

Parameter	Number of patients (50)
Gender(M/ F)	29(58%) / 21(42%)
Mean (average) age (year) ±SD	6.9 ± 2.84 (range:0.25-13y)
Duration of illness in months	
Range	2-72
Mean ±SD	21.1±15.03
EEG +ve	34(68%)
Generalaized EEG discharg	14(28%)
Focal EEG discharge	20(40%)
Temporal:	9(18%) ┐ **(30%) temp.**
Centro temp.	6(12%) ┘
parietal:	1(0.02%)
Frontal:	4(8%)
MRS+ve	36 (72%)
Bilateral:	**7 (14%)**
Right:	**12 (24%)**
Temporal:	9(18%) →
Parietal:	3 (6%) →
Left:	**18 (36%) (46%) temporal**
Frontal:	1(2%)
Parietal:	2(4%)
Temporal:	14(28%) →

Twenty nine (58%) male patient and 21 (42%) female were included in the study with age range (3mo-13y), Mean ±SD was (6.9 ± 2.84) year. The EEG was positive in 34 (68%) of cases, 14 (28%) of cases have generalized epileptogenic activity and 20 (40%) have focal epileptogenic discharges. MRS was positive in 36 (72%) of cases, it was lateralized in 29 (58%) of cases and 7 cases (14%) have bilateral metabolites abnormalities. The temporal lobe was the commonest region of abnormality in both EEG (30 %) and MRS (46%).

Table (3): Clinical data of the included children with epilepsy

Clinical Data	No.	%
Etiology of seizure		
Idiopathic	50	100
Types of seizure		
1-Focal		
- simple partial	0	(0%)
- complex partial	4	(8 %)
- focal with 2ry generalization	7	(14%)
2-Generalized		
- Tonic clonic	25	(50%)
-Tonic	8	(16%)
- Myoclonic	0	(0%)
- Atonic	0	(0%)
-Absence	6	(12%)
Diurnal pattern of seizure		
- Day	24	(48%)
-Night	16	(32 %)
-All day	10	(20 %)
AEDs used		
-Valporic acid	43	(86 %)
-Carbamazapine	4	(8%)
-Livetracetam	40	(80%)
-Ethosuximide	4	(8 %)
-Topiramate	1	(2 %)
-Lamotrigen	6	(12 %)
-Phenobarbital	1	(2 %)
-Gabapentin	4	(8 %)

Table (3) Show the clinical Clinical data of the studied children with epilepsy, all cases had idiopathic epilepsy .Eleven out of 50 children (22%) have focal epilepsy and thirty nine (78%) have generalized epilepsy. Twenty four (48%) of cases have diurnal seizure, 16 (32%) have nocturnal seizure and 10 (20%) case have seizure all through the day. Valporic acid was the commonest used and epileptic drug (86%) followed by levetiracetam (80%).

Table (4): Comparison between the different studied groups according to Chalfont severity scale and abnormal NAA/Cho+ Cr (MRS finding)

	Group 1 (n = 16)	Group 2 (n = 20)	Group 3 (n = 14)
Chalfont severity scale			
Min. – Max.	21 – 86	21 – 150	2 – 150
Mean ± SD.	46.88 ± 25.89	74.80 ± 39.31	51.07 ± 52.70
Abnormal NAA/Cho + Cr			
Min. – Max.	0.48 – 1.20	0.25 – 0.90	0.33 – 1.10
Mean ± SD.	0.72 ± 0.19	0.53 ± 0.17	0.71 ± 0.25
r_s	-0.238	-0.553	-0.937
P	0.374	0.016*	<0.001*

rs: Spearman coefficient

*: Statistically significant at $p \leq 0.05$

From table(4)There is statistically significant difference among groyp 2&3 as regard severity of seizure by chalfont scale and reduction of NAA/Cho+Cr level, with marked decrease in the mean±SD among group 2 (0.53±0.17) and $p < 0.05$.

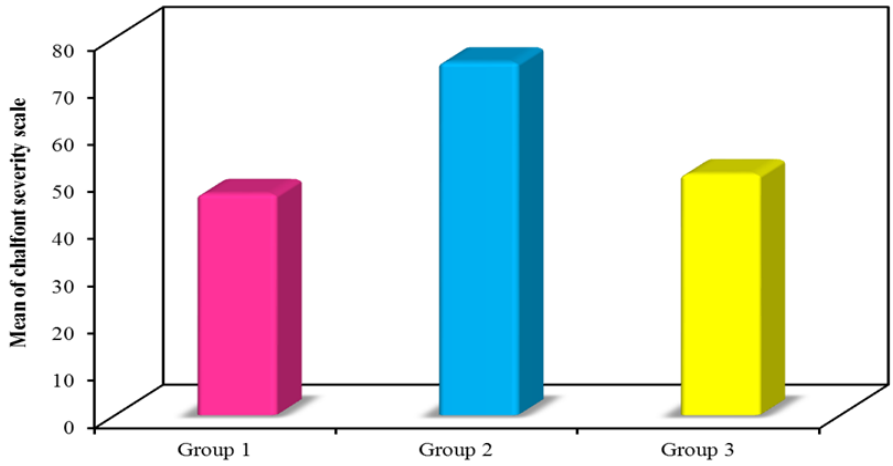

Figure (2): Comparison between the different studied groups according to Chalfont severity scale and abnormal NAA/Cho+cr

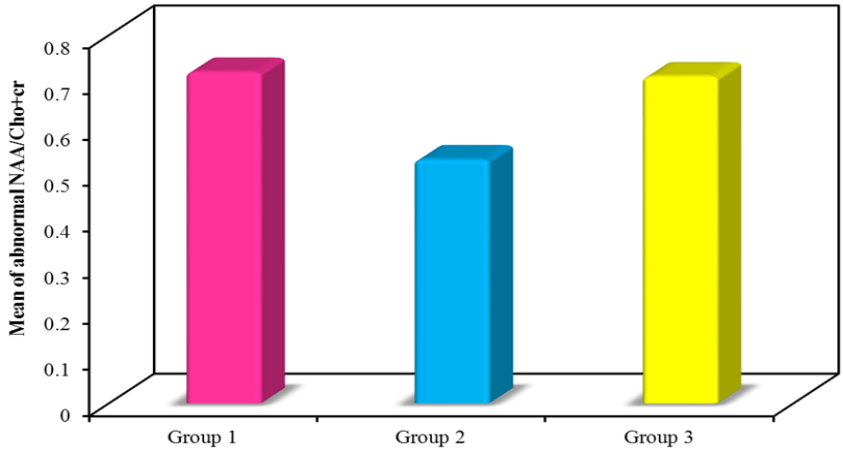

Figure (3): Comparison between the different studied groups according to Chalfont severity scale and abnormal NAA/Cho+cr.

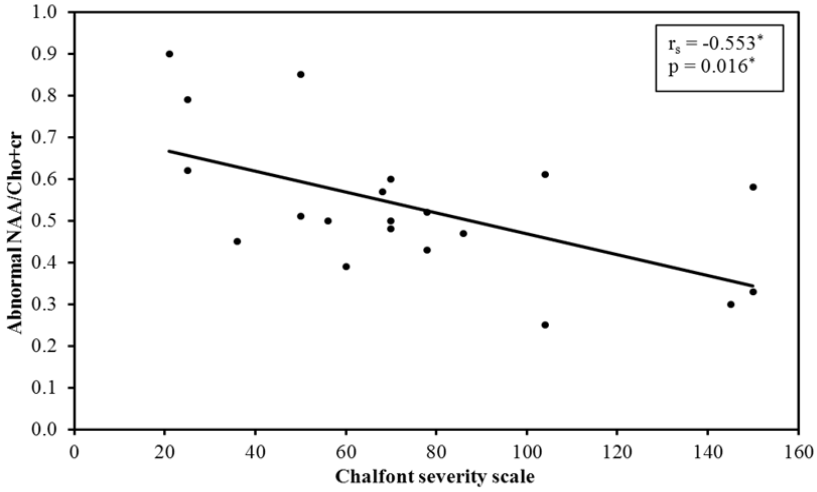

Figure (4): Correlations between Chalfont severity scale and abnormal NAA/Cho+cr in group 2.

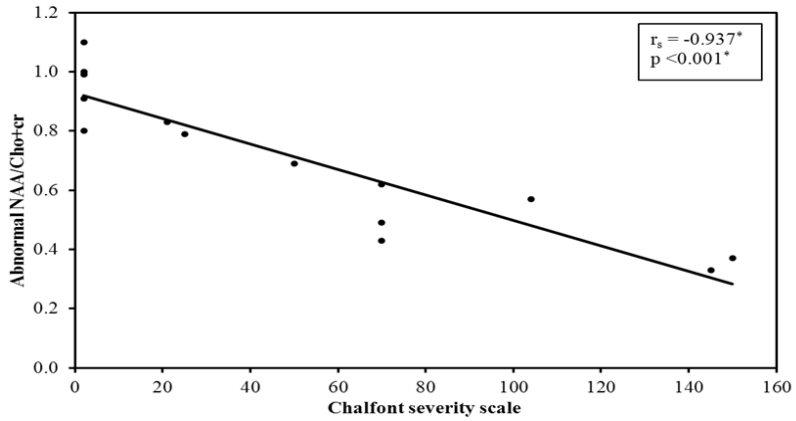

Figure (5) : Correlations between Chalfont severity scale and abnormal NAA/Cho+cr in group 3.

Table (5): Comparison between the different studied groups according to NAA/Cho+cr

NAA/Cho+cr	Group 1 (n = 16)		Group 2 (n = 20)		Group 3 (n = 14)	
	No.	%	No.	%	No.	%
Normal	**5**	**31.2**	**3**	**15.0**	**7**	**50.0**
Min. – Max.	0.73 – 1.20		0.79 – 0.90		0.79 – 1.10	
Mean ± SD.	0.88 ± 0.15		0.85 ± 0.06		0.92 ± 0.12	
Abnormal	**11**	**68.7**	**17**	**85.0**	**7**	**50.0**
Min. – Max.	0.48 – 0.70		0.25 – 0.62		0.33 – 0.69	
Mean ± SD.	0.59 ± 0.07		0.48 ± 0.11		0.50 ± 0.13	

There is marked reduction in the level of NAA/Cho+ Cr ratio in group 2 with focal EEG discharges than than group 1&3 .the mean±SD was(0.48 ± 0.11).

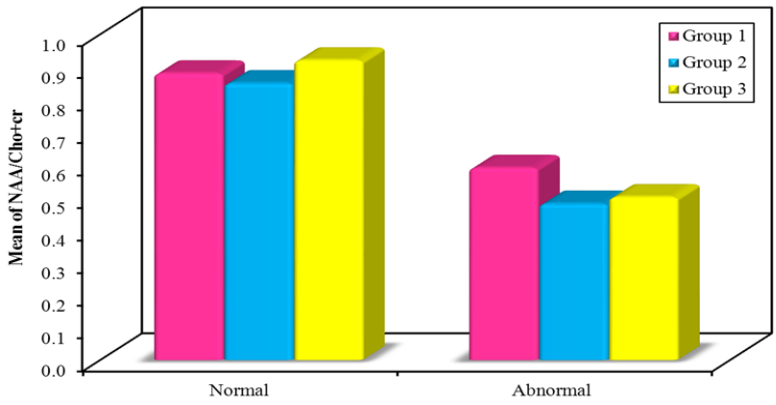

Figure (6): Comparison between the different studied groups according to NAA/Cho+cr

Table (6): Agreement (sensitivity, specificity and accuracy) for MRS

	EGG				Sensitivity	Specificity	PPV	NPV	Accuracy
	-ve (n = 16)		+ve (n=34)						
	No.	%	No.	%					
MRS									
-ve	7	43.8	7	20.6	79.41	43.75	75.0	50.0	68.0
+ve	9	56.3	27	79.4					
X^2(^{FE}p)	2.895(0.105)								

X^2: Chi square test
FE: Fisher Exact

The EEG is considered the gold standard technique for epilepsy diagnosis. The MRS show 79.41 sensitivity and 43.75 specificity to EEG.

MRI, MRS&EEG findings of different encountered patients:

Eight patients (16% of total patient number) were found to have positive findings on conventional MRI study, six of them with diagnostic criteria denoting hippocampal sclerosis, as regards bright signal intensity or structural loss. These patients were classified as follows: 2 patients were found having left side changes, 1 patients having right side changes and 3 patients having bilateral changes on both temporal regions. The remaining 42 patients (84% of total patient number) showed normal MRI appearance of both Hippocampal regions and other brain regions with no appreciable signal

intensity or structural loss noted (these were referred to negative MR cases).

Thirty six patients (about 72% of total patient number) were found to have abnormal MRS finding. Seven patients (14%) have abnormal finding in both sides. Twelve patients (24%) had abnormal data on right side (nine cases 18% temporal, three cases 6% parietal). Seventeen patient (34%) had abnormal finding on left side (one 2% frontal, two 4% parietal, and fourteen 28% temporal. So MRS was lateralized in 29 cases (58%).23 cases (46%) were lateralized on temporal lobe.

EEG was positive in 34 cases (68%), Fourteen cases were generalized epilepsy & Twenty cases (40%) were focal either unilateral or bilateral.

On comparing clinical and EEG findings with those of the MRS data, it was found that 14 cases had bilateral (generalized) clinical and EEG findings and only five of them had bilateral MRS finding. Five cases of this 14 case were diagnosed as Absence epilepsy with normal MRI &MRS finding. So EEG more sensitive in generalized epilepsy than MRS

As regard the lateralization it was found that 29 cases (58%) had MRS lateralization in correlation to 20 case (40%) had focal discharge or lateralization by EEG.

As regard the focal epileptogenic dishrags in EEG, the temporal region was the commonest area about 15 cases from total 20 cases (75%)(Figure 8).

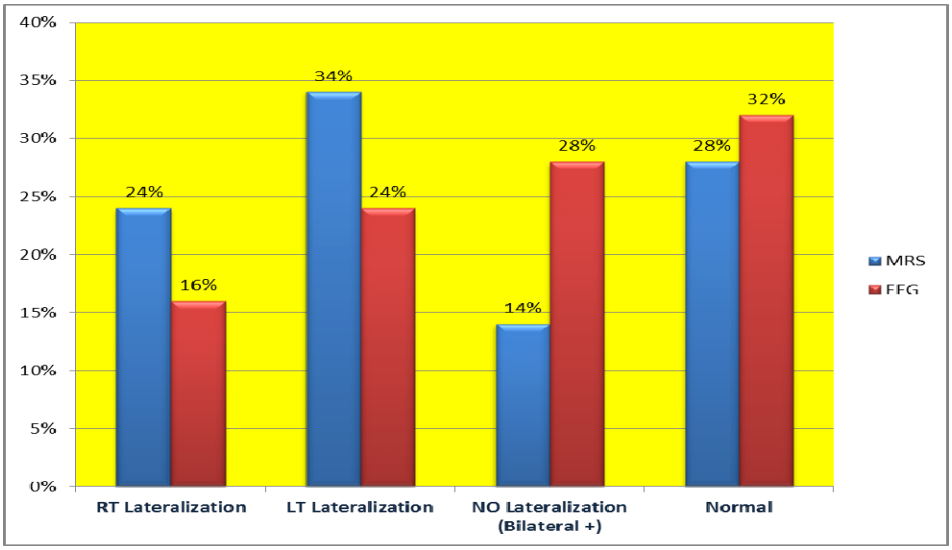

Figure (7): Chart showing EEG &MRS Lateralization in studied cases. From this figure the EEG was more sensitive than the MRS in generalized epilepsy where there is no focus nor metabolites alteration in MRS. But MRS was more sensitive in lateralization related epilepsy.

It was found that 14 cases had clinical generalized seizure activity 5 of them were absence epilepsy with normal MRS findings. Also 7 cases had bilateral finding in MRS (failure of lateralization).

Thus MRS results were nearly consistent with electroencephalography especially in cases with focal EEG discharges.

On comparing MRI findings with those of the MRS data it was found that 8 cases (16%) had positive MR changes, whether signal intensity or structural loss or hypomylination , while the MRI did not find any changes in 42 cases (Negative MRI). However MRS was positive in 36 cases (72%) with (29 cases were lateralized and 7cases failure of lateralization due to bilateral affection) and 14 cases normal findings. (Figure 9).

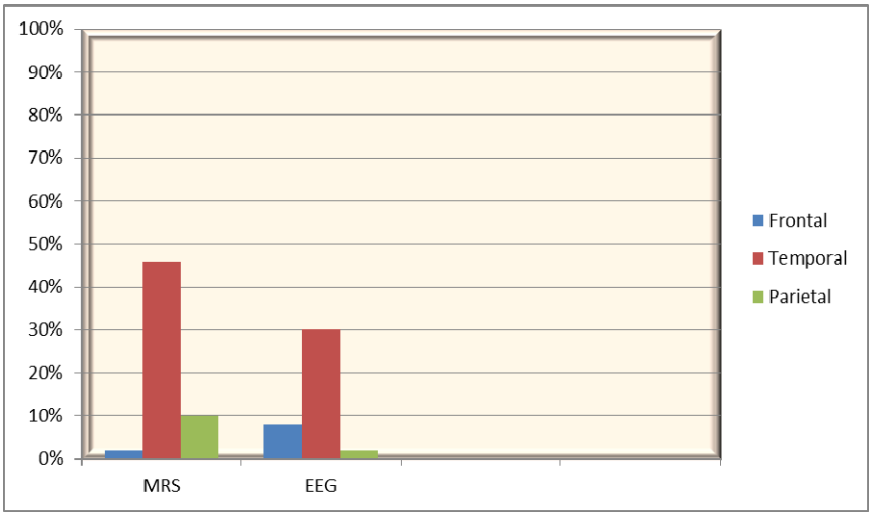

Figure (8): Comparison between EEG&MRS show the most epileptogenic area was the temporal lobe.

MRS revealed abnormal metabolites in 36 cases (72%) with lateralization in 31 cases (62%). In the remaining 14 cases, the MRS revealed normal metabolite ratios. Therefore correct lateralization was achieved in 29 cases. Failure of lateralization was seen in 7 cases, 5 cases due to bilateral affection, and the other 2 were wrong lateralization (in the opposite side of EEG changes).

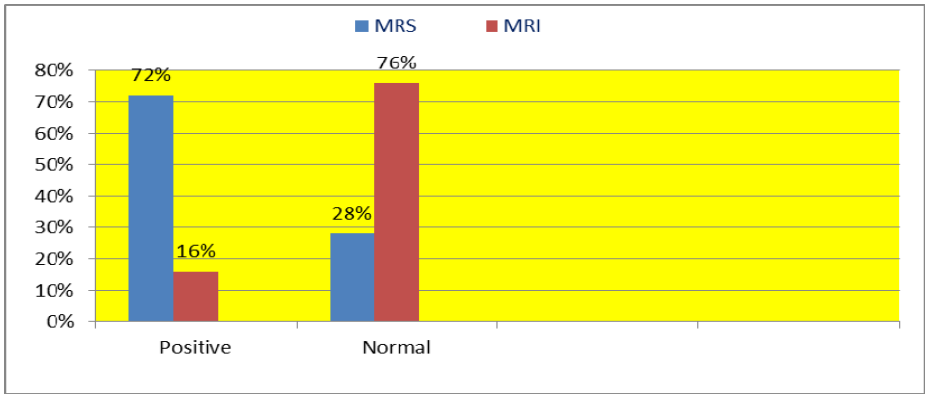

Figure (9): Chart showing comparison between MRI &MRS in studied cases

DISCUSSION

In this study we elected to use clinical and EEG seizure localization as the standard against data which were obtained by proton MRS. Both are considered non-invasive method for localization of seizure. On comparing lateralization by MRS with the gold standard EEG, We found that MRS results were highly concordant mainly in lateralization related epilepsy (focal EEG discharges) more than cases with generalized epileptogenic activity.

The new imaging techniques over the past 20 years have enabled the non-invasive analysis of abnormalities, preceding epileptic seizures and also allowed the use of these approaches in order to reveal the etiologic mechanisms of epilepsy[(10)].

We found no specific contraindications other than those of MRI and could be added to MRS technique and no special instructions were needed apart from patient motion during data acquisition of MRS. MRS and MRI was done in one session in our work.

Many diagnostic imaging tools such as brain MRI, PET, SPECT and H-MRS may be administered and correlated with the results of classical EEG and used in the analysis of epilepsy[(11-12)].

MRS provides in vivo biochemical information. The peaks on the spectra obtained correspond with various metabolites, normal and abnormal, which may be identified precisely. Although peaks from non-identical molecules may overlap, in clinical practice, this is not

usually an issue where brain metabolites are concerned, particularly when scanning at 1.5 T (at higher field strengths this is not necessarily the case)[13].

Proton MRS has the potential to identify metabolic abnormalities before structural changes exist, as shown in many studies that MRS detects abnormalities in patients who had normal MRI examination, i.e. patients with negative MRI. Metabolic abnormality may precede the development of structural lesion, but the connection between the severity of metabolic disturbance and structural lesion is not straight forward[14].

MRI and H-MRS offer a lot of qualitative and quantitative data which can help to localize the epileptic lesions and provide an insight into the biophysical and biochemical processes related to epileptic seizures[15].

The early reports for H-MRS in patients with MTLE were published in the 1990 which tried to lateralize the focal epileptic foci[15, 16].

Examination of patients with epilepsyusing MRS is now focused on the observation of changes in NAA, Cr, Cr2, Cho, Glx and GABA (Gama-aminobutyric acid) signals, their correlations with the results of MRI, EEG findings and the clinical features[17].

In a case- control study, **Azab et al.** [18] assessed the ability of magnetic resonance spectroscopy (MRS) to detect the lateralization side in patients with temporal lobe epilepsy (TLE) in correlation with electroencephalography (EEG) and magnetic resonance imaging (MRI) findings. The study included 40 patients diagnosed (clinically and by EEG) as having temporal lobe epilepsy (aged 8 to 14 years) and 20 healthy children with comparable age and gender as the control group. All patients were subjected to clinical examination, interictal EEG, MRI, and proton MRS. According to the findings of EEG, the patients were classified to three groups: Group 1 included 20 patients with unitemporal (lateralized) epileptic focus, group 2 included 12 patients with bi temporal (non-lateralized) epileptic focus and group 3 included 8 patients with normal EEG. MRS could lateralize the epileptic focus in 19 patients in group 1, nine patients in group 2 and five patients in group 3 with overall lateralization of (82.5%), while EEG was able to lateralize the focus in (50%) of patients and MRI detected

lateralization of mesial temporal sclerosis in (57.5%) of patients. The authors concluded that MRS is a promising tool in evaluating patients with epilepsy and offers increased sensitivity to detect temporal pathology that is not obvious on structural MRI imaging.

In study done by **Mostafa et al.**[19], 30 cases have been examined having abnormal EEG, 17 cases with RT sided EEG, 11 cases with LT sided EEG and 2 cases of bilateral EEG abnormalities.In lateralization using single voxel 1HMRS, the NAA/Cho + Cr ratio was achieved in 26 cases (87.7%), 16 cases at the right side (53%) and about 10 cases at the left side (33%). Four cases had failed lateralization.

In our study the result were in concordant with most of this studies, the MRS results were positive in 36 cases (72%) with 31 cases (62%) were lateralized to either sides and 5 cases were had bilateral abnormalities. The MRI were only positive in 12 case (24%) while the EEG were positive in 34 case (68%)with focal discharge were found in 20 case (40%) in contrast to(62%) lateralization were found in MRS.

So MRS were able to be lateralized the side with electrical discharge in the brain more than the EEG & MRI.

In our studythere were 6 cases (12%) had generalized epileptogenic activity in form of absence seizure documented clinically, 5 of them had posive EEG finding consistent with absence epilepsy but with normal metabolites in MRS examination, So EEG is considered more sensitive than MRS in generalized epilepsy with brief event &MRS were better in lateralization related epilepsy.

Our study also in agree with **Doelken et al.**[14] who report that, Proton MRS has the potential to identify metabolic abnormalities before structural changes exist, as shown in many studies that MRS detects abnormalities in patients who had normal MRI examination, i.e. patients with negative MRI. Metabolic abnormality may precede the development of structural lesion, but the connection between the severity of metabolic disturbance and structural lesion is not straight forward.

In present study the sensitivity of MRS was 72% in contrast to MRI sensitivity was 16%.

In this study, like other studies, such as stated by **Burtscher and Holtas**[20] and others, the ratio of

reduction of NAA to (Cr + Cho) was more important than the absolute decreased intensity value of NAA alone. The critical level of ratio reduction of N-acetyl aspartate in relation to Creatine + Choline (NAA/Cr + Cho) was considered pathognomonic if below 0.71 in unilateral cases of temporal lobe epilepsy as compared to the contra-lateral normal side.

Lateralization findings on epileptic focus by MR spectroscopy agreed with the data obtained from the clinical and EEG and in most patients under abnormal fundus examination in their HBAIc.study.

Our study also in agree with **Connellyet al.**[21], investigated 25 cases of TLE using single voxel 1H MRS. Lateralization was possible in 18 cases using the NAA/Cho + Cr ratio (72%). The mean NAA/Cho + Cr ratios were significantly less in patients with TLE, with even contralateral affection in some patients with the ipsilateral side more affected.

CONCLUSION

MR Spectroscopy is a very sensitive guiding tool in predicting the TLE and the side of involvement in patients with TLE even in patients with MR negative studies. It helps in detecting abnormal spectra of various brain metabolites. The side of maximum reduced NAA/Cho + Cr ratio often coincides with the side of EEG abnormality. MRS can also detect bilateral affection with the ipsilateral side more affected. The abnormal metabolite ratios can be found to affect the brain tissue beyond the hippocampus reaching to the neocortex. In cases with generalized epilepsy the EEG was more sensitive than MRS mainly in absence epilepsy.

RECOMMENDATIONS

MRSI can easily be considered as an alternative modality of choice in the diagnosis lateralized or focal epilepsy mainly of temporal lobe in origin due to its higher sensitivity compared to other imaging modalities for the detection of epileptic metabolites in mesial lobe structures and with further increasing experiences mainly in molecular imaging.

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الملخص العربي

تعتبر نوبات التشنجات في الأطفال من أكثر الإضطرابات العصبية في الأطفال وأن نسبة من 4% إلي 10% من الأطفال يعانون علي الأقل من نوبة واحدة من التشنجات خلال ال 16 عاما الأولي من العمر. وأن أعلي معدل في الأ طفال خلال السنوات الثلاثة الأولي من العمر. أثبتت الدراسات الوبائية أنه في كل عام ما يقرب من150 الف طفل يعانون من اول نوبة تشنجات غير معرفة السبب وأن مايقرب من 30 ألف منهم سوف يعانون من مرض الصرع.

وكان الغرض من البحث هو تقيم مدي توافق التغير الأيضي في الفحص الطيفي بالرنين المغناطيسي مع التخطيط الدماغي في تحديد مكان البؤرة الصرعية وتشخيص الصرع في الأطفال.

وقد أجريت هذه الدراسة علي 50 طفلا (29 طفلا من الذكور و21 طفلا من الإناث) وذلك في الفترة من ديسمبر 2016 وحتي أغسطس 2018 وكان جميع هؤلاء الأطفال يعانون من نوبات صرعية سوءا كانت جزئية أوعامة وتم إختيارهم من عيادة الأمراض العصبية للأطفال بمستشفي سيد جلال الجامعي-جامعة الأزهر. وقد خضعت جميع حالات الدراسة للفحص الإكلينيكي ومعرفة التاريخ المرضي وتم عمل رسم المخ الكهروبائي الروتيني والتصوير بالفيديو وكذلك الفحص الطيفي بالرنين المغناطيسي باستخدام تقنية الفوكسل المتعدد.

وأظهرت النتائج أن 36 حالة (72%) من المرضي كانت نتائج الفحص الطيفي إيجابية .منهم 7حالات (14%) كانت النتائج ايجابية علي الجانبين و12 حالة(24%) كانت النتائج اييجابية علي الجانب الأيمن 17 حالة (34%) و كانت النتائج اييجابية علي الجانب اليسر من المخ.وبذلك تكون نتائج الفحص الطيفي بالرنين المغناطيسي استطاعت تحديد البؤرة المحدثة للصرع في إحدي وثلاثون حالة (62%). بينما كانت نتائج رسم المخ الكهربائي إيجابية في 34 حالة(68%) منهم 14 حالة كانت النتائج ايجابية علي الجانبين و12 حالة(24%) و كانت النتائج ايجابية علي الجانب اليسر من المخ و8 حالات(16%)كانت النتائج ايجابية علي الجانب الأيمن.وبذلك يكون رسم المخ الكهربائي استطاع تحديد البؤرة

الصـرعية فـي 20 حالـة (40%) مقارنـة ب (62%) فـي الفحـص الطيفـي بـالرنين المغناطيسي. وبذلك يكون استخدام الفحص الطيفي بالرنين المغناطيسي في تحديد البؤرة الصرعية اكثر حساسية من رسم المخ الكهربائي. ويعتبر الفص الصدغي أكثر مناطق المخ احتواءا علي البؤرات الصرعية.وأن نتائج رسم المخ الكهربائي كانت متقاربة ومتوافقة مع نتائج الفحص الطيفي بالرنين المغناطيسي في النوبات ذات البؤرة الصرعية اكثر منها في حالة النوبات الصرعية العامة.

ويعتبر إن استيل اسبرتيت من أهم الدلالات في الفحص الطيفي بالرنين المغناطيسي في حالات الصرع حيث إن إنخفاضة يعكس وجود خلل أو فقدان في الخلايا العصبية.

وهناك بعض المرضي كانت نتائجهم سلبية بإستخدام الطرق التقليدية للرنين الغناطيسي(24% نتائج إيجابية) ولكن بإستخدام الفحص الطيفي تبين وجود خلل في معدلات الأيض (72% نتائج إيجابية) قبل ظهور خلل أوعيوب الطرق التقليدية للرنين الغناطيسي.

ويعتبر الطيفي بالرنين المغناطيسي وسيلة غير تداخلية ومكملة في تشخيص الصرع من خلال تحديد التغيرات الكيميائية وقياس مقدارها ونسبتها.