Adult Epilepsy & the Value of Neuro-Imaging

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Abstract:

Background: neuro imaging has become as important as the use of EEG in the diagnosis of epilepsy. MRI Remains the principal technique used in epilepsy.

Objective: to detect a specific imaging abnormality on MRI and CT scan in a given patient and their effect on the management and prognosis.

Method: a total of fifty nine patients with epilepsy referred for Neuro imaging to Al-Yermouk General hospital in Baghdad from November 2009 –January 2011 with age between 18 –70 yrs. male 26: female 33. Fifty patients underwent CT scan of the brain and 56 had MRI study.

Results: Forty six (82%) had abnormal neuroimaging on MRI compared to CT scan which showed only twenty five patients (50%) abnormal study. MRI is more sensitive than CT scan in the detection of medial temporal sclerosis (MTS, hippocampal sclerosis) and abnormal white matter. CT scan is more accurate in showing acute intracranial hemorrhage and lesions with underlying calcifications.

Conclusion: MRI and CT scan are useful to identify the origin and cause of seizure disorders. However, MRI is the principle imaging technique used in adult onset epilepsy but CT is still crucial in emergency conditions, when MRI is unavailable or contra indicated.

Keyword: epilepsy, Neuro imaging, adult.

Introduction:

Epilepsy is a neurologic disorder characterized by spontaneous recurrent seizures caused by excessive and abnormal electrical discharges from the cortical neurons [1,2].

It is either focal or generalized. Focal epilepsy is associated with 5 groups of Epileptogenic substrate including mesial temporal sclerosis (MTS) ,malformation of cortical development, neoplasm's, vascular abnormalities and gliosis[3,4,5].

Magnetic resonance imaging is generally the imaging modality of choice for identifying the structural bases of chronic focal epilepsy. A large retrospective neuro imaging study investigated a broad spectrum of individuals with seizures, it detected CT or MRI abnormalities in more than 50 % of patients with focal epilepsy [2,6]. However, CT scan is still the technique of choice for the investigation of patients with seizures and epilepsy under emergency conditions because it can accurately detect Hemorrhage, infarction and lesions with underlying calcifications. It offers speed accessibility and easy use [7].

Method:

A total of 59 patients were arranged for MRI study, CT scan or both .out of these, 26 Male and 33 Female. There ages ranging between (18-70 years) in Al Yermouk Teaching hospital in Bagdad in the inpatient radiological department from 2009 to January 2011.

The decision to perform MRI or CT scan was based on the clinical judgment of the referring Neurologist or Gynecologist (referring several cases of unexplained seizers after delivery) but a comparative study between the two imaging modalities to show the advantages and disadvantages of each, was the aim of our work study, therefore both MRI and CT scan were undertaken for most of the referred patients.

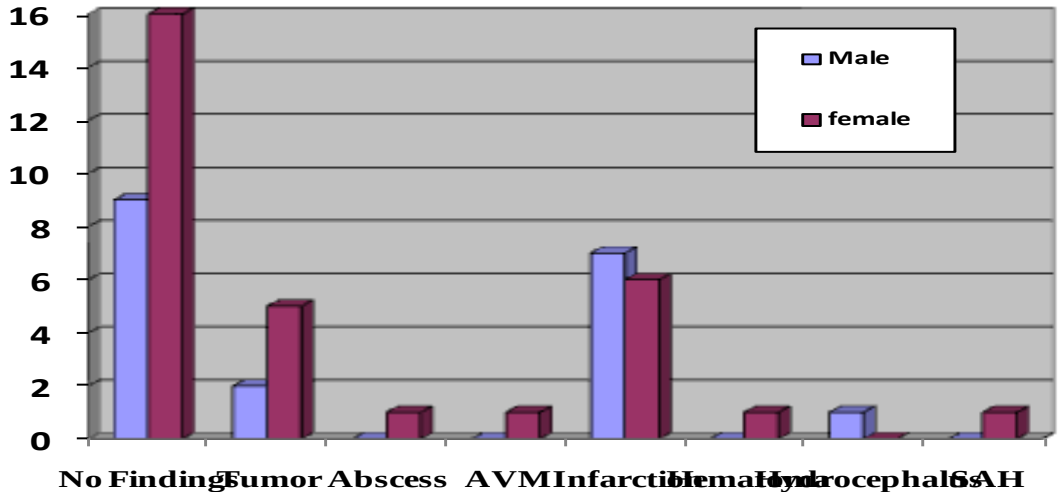
Fifty six patients underwent MRI study and were scanned on a clinical of 1.5 T Philips Gyro scan Medical system ACS –NT. The imaging protocol consist of a sagittal T1 weighted spin echo (T1 SE), axial T2 turbo spin echo (T2 TSE) , coronal Fluid attenuated inversion recovery (FLAIR) and axial fat suppression. Fifty patients arranged for brain CT scan study utilizing the spiral CT scan soma tom plus 4 models 1999, KV 140, MAS 120, minutes 39 sec.

Results:

Table (1):- Finding of CT scans in both male and female

	Findings on CT Scan	Male	Female	Total
1	**No Findings**	9	16	25
2	**Tumor**	2	5	7
3	**Abscess**	-	1	1
4	**AVM**	-	1	1
5	**Infarction**	7	6	15
6	**Hematoma**	-	1	1
7	**Hydrocephalus**	1	-	1
8	**SAH**	-	1	1

Figure (1):- refers to the study sample according to CT scan findings



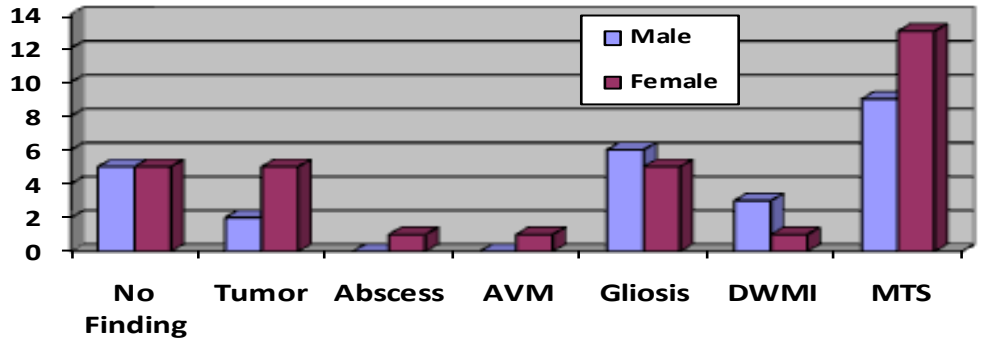
Table(2):- Refers to the distribution of study sample according to MRI findings

	Findings on MRI	Male	Female	Total
1	**No Finding**	5	5	10
2	**Tumor**	2	5	7
3	**Abscess**	-	1	1
4	**AVM**	-	1	1
5	**Cortical Gliosis**	6	5	11
6	**Diffuse W. M. hyper intensity**	3	1	4
7	**MTS**	9	13	22

Table (3) Number and Percent of cases with Positive and Negative Neuro-imaging finding in Both MRI and CT.

	No. of Cases With Positive Findings	Per Cent of Cases With Positive Finding	No. of Cases With Negative Findings	Per Cent of Cases With Negative Finding
Finding on MRI	46	77.96%	10	16.94%
Finding on CT	27	45.76%	25	42.37%

Figure (2):- showing No. of cases according to MRI findings



As shown in table 1 ,table 2 ,and table 3 abnormal neuroimaging observed in 46 patients (82.7 %) on MRI , but on the other hand only 25 (50%) patients with abnormal brain CT scan noted.

In the detection of hippocampal sclerosis, (MTS), MRI is clearly superior to CT scan in its ability to show deep white matter hyper intensities involving the medial portion of the temporal cerebral lobes, it is the most common pathology observed in the study sample which is seen in 22 patients (39.3%).

CT scan is more accurate in showing intra-cerebral hematomas and SAH .

Nine patients arranged for CT scan only which was preferable and fair enough without the need for a comparative MRI study, these were.. **1** SAH, **1** Hematoma, **1** hydrocephalus and **six** patients with multiple shell injury were MRI is contra indicated. Diffuse white matter hyper intensities seen in 4 patients on MRI (7%).

Both Imaging modalities were comparable in showing brain tumors and cortical scars.

Discussion:

Magnetic resonance imaging is generally the method of choice not only in the detection of the anatomic location of the substrate but also in depicting the relation of the substrate to the eloquent region of the brain (e.g. Cortices involved with motor , speech or memory function) [2,4,7]. Computed tomography retains a role supplementary to MRI in the recognition of intracranial calcifications that may not be easily identified by MRI [1,5,8], it is also useful when there is high suspicion for SAH and when MRI is not available or contraindicated[2].

A retrospective neuro-imaging study investigated a broad spectrum of individuals with seizures, it detect CT scan or MRI abnormalities in more than 50 % of pts. With epilepsy, clinical MRI detects an underlying structural pathology in up to 75% of patients [2,6]. These findings are comparable to our reported cases of 50 % and 82 %f abnormal neuro imaging on CT and MRI studies respectively.

Hypocampal sclerosis (MTS), is a condition in which neuronal loss in the pyramidal cell layer of the cornu ammonis and the granular cell layer of the dentate gyrus and gliosis within the hippocampus lead to re-organization of neuronal circuitry within the hippocampus causing increase intensity signal on T2 weighted images. It is the most common pathology in refractory seizure disorders, found in 32 % of patients but in only 1-2 % of patients with newly diagnosed partial epilepsy, it is a more common cause of epilepsy in adult [7,9]. A community based study showed that almost all patients with MTS have a non diagnostic CT and That the diagnosis is best done non invasively with MRI, showing T2 abnormalities (hyper intensities) in the hippocampus[3].

If lesions are detected in the epileptogenic region, this facilitate presurgical decision making and indicate a better surgical outcome [10]. MTS appears in about 65% of cases in some series [11], in another recent study using the 3T phased array surface coil; MTS appears in up to 93% [12.]. In our series, it is seen in 39.3%. The difference between our data and other work study is probably attributed to the heterogeneity of the MRI field strength (0.2, 1.5 and 3T), imaging quality and more advanced imaging techniques as the functional MRI and spectroscope MRI. However, the increase sensitivity in the detection of small lesions related to the hippocampus with the new MRI method often comes at the cost of an increase rate of false positive results [4].

Cerebral scars findings were comparable on both CT and MRI In our study it is, observed in about 19 – 26 % of cases, in other series it represent more than 20% of cases with MRI study [7].

Benign tumors may underlie refractory epilepsy, they are calcified as benign because they typically lack mass effect and are stable on several imaging [4]. Both CT and MRI were comparable in our study reported about 13% in our series, which is lower than the 20% reported by other studies [4]. This is possibly attributed to the more frequent selection of elderly patients (in other populations) in whom small intracranial tumors are found in the old people, which is not rare, during investigation for epilepsy [13].

In general, the clinical value of neuro-imaging strongly depend on the expertise of those who acquire, read, and interpret the images[14], on the other hand the diagnostic yield of MRI is additionally influenced by technical development of epilepsy specific MRI protocols in specialized centers, this is of great value especially in patients with proven refractory epilepsy but inconsistent imaging finding, repeat examinations might be helpful [5,8].

IN conclusion, MRI is generally the imaging modality of choice for identifying the structural bases of chronic focal epilepsy, CT retain a role supplementary to MRI in the recognition of intracranial calcifications that may not be easily identified on MR (calcifying lesions appear as signal void on MRI undisguised from vascular malformations or high speed intravascular blood flow) . It is also useful when there is high suspicion for SAH and cerebral hematomas (appearing always hyper dens on CT, but on MRI ,non specific according to the timing of cerebral insult or may mimic a cerebral tumor) or when MRI is contra-indicated, it is preferred for the acutely ill patients, If MRI compatible monitoring equipments and anesthetic support is unavailable.

References

1- Commission on classification and Terminology of international league against Epilepsy proposal for revised classification of epilepsies and epileptic syndromes. Epilepsia. 1989, 30: 389-390.

2- Kwanp, Brodie M., Early identification of refractory epilepsy. N Eng. J. med. 2000; 342: 314 -19.

3- Spencer D. classifying the epilepsies by substrate. Clinical neuro-sci. 1994, 2: 104-9.

4- Venkatramana R., Vattipally, MD, Richard A, Bromen, MD. MRI of Epilepsy : Strategies for successful interpretation in : Ronald L. wolf , MD , PhD : Neuroradilogy Essentials : Radiol .clinic NAm p. 49 , 2006 ELSEVIER SANDERS.

5- Friedrich G. Woermann, Christian. Vollmar, clinical MRI in children and adult with focal epilepsy; a critical review. Epilepsy and behavior, Journal home page: www. Elsevier. Com \ locate 2009; 15: 40-49.

6- Wieshman UC. Clinical application of neuroimaging in Epilepsy .J Neurol. Neurosurgery psychiatry 2003; 74: 466-70.

7- Robin I. kuzniescky, Neuroradiology in epilepsy. Continuum lifelong learning Neurol. 2008; 14 (4): 175-187.

8- Maher Ursakar et al. Imaging in Epilepsy well spring Jankharia imaging. Downloaded free from http: www. Pediatric Neuro-science. com. 2010. I.p:109. 224. 28. 33.

9- Koepp MJ. Woermann FG. Imaging structure and function in refractory focal epilepsy, Lancet Neurol. 2005: 4: 42-53. Spencer s. Focal brain MRI findings: transient signal changes secondary to seizures (abstract) neurol. 1992: 42 (suppl 3): 206.

10- Liu RS, Lemievx L, Bell Gs , et al. Progressive neocortical damage in epilepsy Ann Neurol 2003; 53: 312-24.

11- Goyal M, Bangert BA, Lewin JS, Cohen ML, Robinson S, High resolution MRI enhances identification of lesions amenable to surgery .Epilepsia 2004; 45: 954-959.

13 -Stavia B, Ivan M: Imaging in neurological diseases; brain and cranial nerves. In Mario G., Pauline F., Martin J., Walter L, David J: In Diagnostic imaging in the elderly. Published in UK in 2002 by Martin Dunitz Ltd. p 252-53.

14- Selman pera TM, Symms MR, Rugg-Gum FJ, et al. Evaluation of quantitative magnetic resonance imaging contrasts; MRI negative refractory focal epilepsy, Epilepsia, 2009; 50:155-60.

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