Original Article

Value of neuroimaging in epilepsy: An experience from Pakistan

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ABSTRACT

Purpose: To detect the possible structural brain lesions in the patients suffering from various kinds of epilepsy during the routine neuroimaging. **Materials and Methods:** Prospective study of 366 epileptic patients conducted at epilepsy clinic, Rawalpindi-Islamabad Pakistan in an outpatient setting. MRI or CT scan of the brain without contrast was advised in all patients to detect any underlying pathology. **Results:** A total 21.31% scans were found to be abnormal. Many cases of familial, idiopathic epilepsy and patients without any neurological deficit were found to have structural brain lesions, which might be responsible for their seizures. **Conclusion:** CT/MRI scan of the brain should be advised in all patients of epilepsy regardless of cause and type of epilepsy. The presence of neurological deficit should not be the sole indication for neuroimaging.

Key words: Computerized tomography scan, epilepsy, familial, idiopathic, magnetic resonance imaging scan, neurological deficit, partial, surgery

Introduction

The modern techniques of neuroimaging have exposed many surgically amenable lesions in epileptic patients.[1] The International league against epilepsy recommends computerized tomography (CT) scanning of the brain in all patients with epilepsy regardless of the cause and type of the seizures. However, in CT-negative cases, magnetic resonance imaging (MRI) has been strongly recommended.[1,2]

In the developed countries, due to an easy access to the latest technologies, epileptic patients are investigated with high-tech imaging studies like functional MRI, magnetoencephalography, single photon emission tomography, and positron emission tomography.[3]

In third world countries, the latest medical imaging techniques are beyond the reach of many epileptic patients. Hence, brain scanning is barely done in any case. Only the patients with a new neurological deficit, late onset of epilepsy or drug-resistant cases are advised for neuroimaging. The patients with a family history of epilepsy or without any neurological deficit are in general either ignored or deferred for any further investigation.[4]

Deciding which patients to investigate is a major dilemma in the practice of neurology. In idiopathic generalized epilepsies and in some partial seizures, brain imaging shows to be normal. On the other hand, many epileptic patients may harbor life-threatening lesions without any physical evidence.[5]

This paper will clarify how many epileptic patients, who apparently did not need neuroimaging, were discovered with structural lesions during their brain scanning. Moreover, it will also be highlighted how different socio-economic milieu in developing world precludes an ideal practice and delivery of standard care of epilepsy.

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Materials and Methods

One thousand epileptic patients attended the Avicenna Epilepsy clinic. Those patients who were clinically suffering from epilepsy, regardless of cause, type or

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neurological status, were selected. Patients less than one year of age, cases suffering from a first seizure, pseudoseizures, atypical seizures, and pregnant females, seizures secondary to any metabolic disorders, and seizures with a frequency of only one per annum were not included in the study.

The diagnosis of epilepsy was made only on clinical history due to a lack of electroencephalographic (EEG) facility. The complete physical and neurological examinations of all patients were done on more than one occasion. Pre-ictal, ictal, and post-ictal symptoms were carefully and repeatedly elicited both from patients and their families to find out any clue of focal onset of epilepsy. Author has also directly observed the seizures in some patients at the time of interview.

All routine laboratory/radiology investigations like complete blood picture, liver/renal functions test, and urine analysis, coagulation profile, thyroid functions tests, and chest radiography were done to find out any associated illness. In selective cases, particularly in females, ultrasonography of both abdomen and pelvis were also done to rule out any unknown pathology.

All patients were then advised to have either CT or MRI of brain without contrast, at their own expenses. None of these patients ever had either CT or MRI brain scan before. CT of brain was done in 10-millimeter thickness axial cuts by CT scanner of Toshiba Company. In MRI, T1, T2-weighted and Flair images at 5 millimeter interval in sagittal, coronal, and axial planes were taken. All MRI brain scans were done without any sedation. MRI scanner of one Tesla of Siemens Company was used. All CT/MRI scans were done without contrast to cut down the cost of imaging. No epilepsy protocols or hippocampus volumetry was done in any MRI brain scans. All scans were reported by general radiologists who were provided detailed history of patients. Whole study was conducted on outdoor basis.

Table 1: Age range of the patients

Age range	No. of patients
1-10	53
11-20	140
21-30	100
31-40	40
41-50	18
51-60	8
61-70	7

Table 2: Clinical types of seizure

Generalized tonic clonic	282 (77.04%)
Complex partial seizure leading to generalized tonic clonic	70 (19.12%)
Partial motor fits leading to generalized tonic clonic	10 (2.73%)
Juvenile myoclonic epilepsy	2 (0.54%)
Complex partial seizures	2 (0.54%)

Table 3: Causes of seizure

Causes of seizure	No. of cases (%)
Idiopathic	196 (53.55)
Familial	120 (32.43)
Post traumatic	26 (7.02)
Post meningitic	20 (5.40)
Post stroke	4 (1.08)

Results

There were 240 males and 126 females. The majority of patients were in the second and third decades of their life (mean age was 19.5 years) [Table 1].

Generalized tonic clonic seizures were the most common, followed by complex partial seizures leading to the generalized seizures. The partial motor or sensory seizures were not observed in any patient [Table 2]. Familial and idiopathic epilepsy were found to be more common. The seizures secondary to stroke were seen only in 1.08% patients [Table 3].

More than 98% of patients had no neurological deficit at the time of presentation. Among them, 19 patients were mentally retarded and six patients were psychotic. The neurological deficit in the form of spastic hemiparesis, monoparesis, and dysphasia was recorded only in 1.62% patients.

The CT scans of the brain were done in 339 patients and MRI brain in 44 patients. The 78 brain scans were found abnormal showing various brain pathologies ranging from arteriovenous malformation, gliomas, meningiomas, and infractions [Figures 1-3, Tables 4 and 5].

All patients suffering from a neurological deficit had different pathologies on their brain scans except one in which CT brain failed to pick up any lesion. This patient was not further evaluated by MRI of the brain due to financial constraint.

Discussion

Many patients in this study were males and in the second decade. This sex preference has been quoted by other studies as well.[3,6]

Epilepsies are traditionally classified either generalized or focal. Sixty percent of all epilepsies are of focal

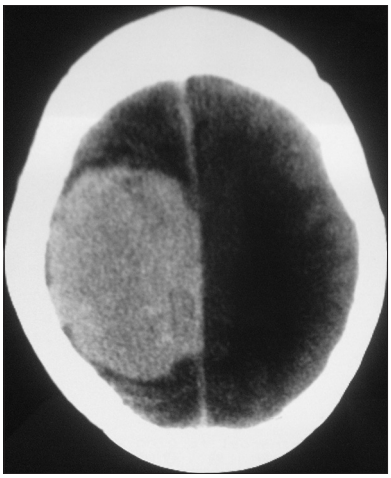

Figure 1: CT Brain showing meningioma

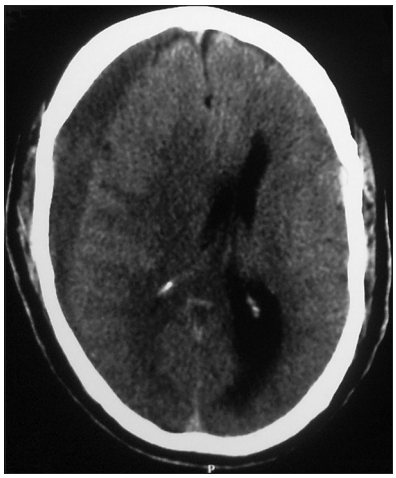

Figure 2: CT Brain showing subdural hematoma

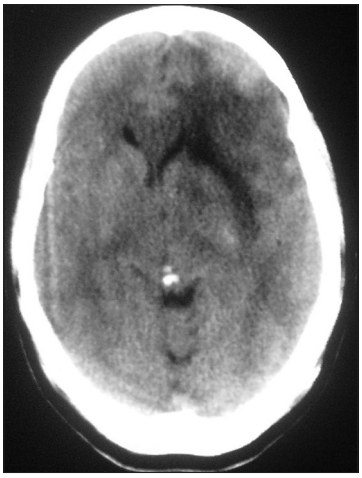

Figure 3: CT Brain showing glioma

onset. In this study, generalized epilepsies were found to be more common than partial epilepsies. This was because seizures classification was based on clinical symptomatology due to lack of EEG facilities. Other studies also reported the similar high incidence of generalized seizures, possibly because of the same reasons and limitations.[6-8]

Table 4: Lesions discovered on CT Brain imaging

Pathology	No. of patients
Cerebral atrophy	17
Infarctions	15
Encephalomalacia/Hypodense areas	12
Gliomas & calcified masses	7
Calcifications	7
Arachnoid cysts	2
Meningiomas	2
Subdural hematoma	2
Depressed fracture	1
Arteriovenoum malformation	1
Hemiatrophy of brain	1
No lesion detected	271

CT: Computed tomography

Table 5: Lesions detected on MRI Brain imaging

Pathology	No. of patients
Encephalomalacia/Hypodense areas	5
Mesial temporal sclerosis	4
Infarctions	3
Arachnoid cysts	2
Glioma	2
Arteriovenous malformation	1
Meningioma	1
Cerebal atrophy	1
Hydrocephalus	1
No gross pathological lesion detected	24

MRI: Magnetic resonance imaging

Whether these generalized epilepsies are idiopathic or cryptogenic, clinically it is difficult to differentiate.[9] All these patients were free of neurological deficits. These patients never had any aura. No apparent cause of seizures was found on their clinical examination. It was also difficult to extract aura or pre-ictal symptoms in children and in patients suffering from nocturnal epilepsy, mental retardation, psychosis, and depression. Since, history-based classification is not reliable, therefore, from this data, it should not be extrapolated that generalized epilepsies are indeed more common.

This is decidedly true that epilepsy is, by and large, free of neurological deficit and is apparently a benign process. Those patients, who present with a neurological deficit, certainly harbor some brain pathology. That is why these patients are investigated without fail. On the other hand, 98% of epileptic patients who have no neurological deficit will not be selected for routine neuroimaging. Epilepsies with psychosis and mental retardation are also considered as genetic and functional

disorders. Hence, such patients are not considered as suitable candidates for the expensive investigations. The routine neuroimaging is also discouraged so not to uncover any incidental findings, which might have no relationship to the epilepsy.[10]

Our study clearly condemns and dispels such types of misunderstandings and beliefs. Our routine neuroimaging discovered many brain pathologies, which were not only surgically amenable but also might be responsible for the seizures.

In 20% cases of familial epilepsy, 31.57% cases with mental retardation and 50% cases with psychosis, significant brain pathologies were detected. A total 21.31% scans were found to be abnormal. Other studies also reported similar findings.[7,11]

In the past, generalized epilepsies were considered as idiopathic, but now, many underlying structural and developmental abnormalities are being detected that were previously diagnosed only at postmortem.[12-14]

Idiopathic and familial epilepsies were predominant types of the seizures in this study. Post-meningitic and post-traumatic types were seen in 5.40% and 7.02% cases, respectively. These findings are also coherent with other studies.[6]

Epilepsy may develop in many slow-growing tumors and other benign lesions like occult arteriovenous malformations and focal cortical dysplasia. Incidence of brain tumors in epilepsy is usually quoted as 5% to 14%. Many such patients have normal neurological examination, and imaging is also negative. Only repeated brain images could reveal such abnormalities. These kinds of the patients are most likely to be missed.[15,16]

Mesial temporal sclerosis (MTS) is characterized by firm and atrophic hippocampus and presence of neuronal cell loss and gliosis in CA1, CA3, and CA4 sub-fields of the hippocampus.[17] These patients are usually free of neurological deficit. This study found MTS only in four patients because MRI was not possible in all patients. This pathology cannot be picked up by CT brain imaging. Therefore, high resolution MRI with dedicated epilepsy protocol should be the investigation of choice. Particularly in children, MCD (malformation of cortical development) is common cause of epilepsy, and MRI is only modality, which can detect these abnormalities more precisely.[12]

The most exciting finding in this study was that no patient ever had any sort of neuroimaging. Sixty three percent of patients were not able to afford any type of brain scanning. It has been reported from India that more than 50% of patients never had neuroimaging.[8]

Hypodense areas of significant size were discovered in many patients on the brain CT scans [Figure 4]. Radiologists reported these lesions as infarctions, gliosis, or encephalomalacia. These lesions might be due to past head trauma or due to head injuries associated with seizures. Whether these areas are truly epileptogenic is not known. Surgical removal of such gliotic areas could bring much relief to the patients if these lesions were found to be the cause of epilepsy. Such cases need further investigations in order to prove or disprove their propensity for epileptogenesis.

However, it should be strongly emphasized that all brain lesions are not epileptogenic. Therefore, surgery may or may not reduce the frequency of seizures. There is no simple test to localize the epileptogenic zone. The two basic technological requirements mandatory for pre-surgical assessment are high resolution MRI and video-EEG telemetry. Modern neuroimaging have obviated the need of many previous invasive and sub-invasive investigations. Nonetheless, availability of such technologies in developing countries is still a nightmare.

Although this study underscores the importance of routine brain imaging in epileptic patients, it is not an ideal study. Some limitations of study are being acknowledged like diagnosis of epilepsy was not based on EEG and MRI brain, which is an ideal investigation, was not possible in all cases. Moreover, all brain scans were done without contrast, and histopathology reports of discovered brain lesions were not available.

Though there is a considerable need to investigate all epileptic patients, clinical acumen should always prevail

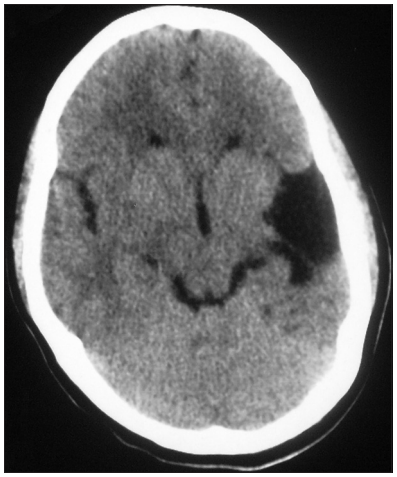

Figure 4: CT Brain showing encephalomalacia

in order to safeguard the tendency of over investigations in areas with limited economic resources. Epilepsy is a long-term illness. It is not only the diagnosis of disease or prescription of anti-epileptic drugs. It really needs fight from every frontier.

Conclusions

The neuroimaging should be an essential part in the management of epilepsy. The presence of neurological deficit should not be the only criteria for the neuroimaging. Principally, all epileptics should be investigated to find out the drug-resistant and potential cases of epilepsy surgery.

References

1. Kuzniecky RI. Neuroimaging of Epilepsy: Therapeutic Implications. Neuro Rx 2005;2:384-93.
2. Barkovich AJ, Berkovic SF, Cascino GD, Chiron C, Duncan JS, Gadian DG, *et al*. Guidelines for Neuroimaging evaluation of patients with uncontrolled epilepsy considered for surgery. Epilepsia 1998;39:1375-6.
3. Brodie MJ, Shorvon SD, Canger R, Halász P, Johannessen S, Thompson P, *et al*. Commission on European Affairs: Appropriate standards of epilepsy care across Europe. ILEA Epilepsia 1997;38:1245-50.
4. Radhakrishnan K. Challenges in the management of epilepsy in resource-poor countries. Nat Rev Neurol 2009;5:323-30.
5. Wieshmann U. Clinical application of neuroimaging in epilepsy. J Neurol Neurosurg Psychiatry 2003;74:466-70.
6. Shorvon SD. Epidemiology, classification, natural history and genetics of epilepsy. Lancet 1990;336:93-6.
7. Abduljabbar M, Ogunniyi A, Daif AK, Al-Tahan A, Al-Bunyan M, Al-Rajeh S. Epilepsy classification and factors associated with control in Saudi adult patients. Seizure 1998;7:501-4.
8. Thomas SV, Kutty R 5th, Alexander A. Management and referral patterns of epilepsy in India. Seizure 1996;5:303-6.
9. Wright NB. Imaging in epilepsy: A pediatric perspective. Br J Radiol 2001;74:575-89.
10. Vernooij MW, Ikram MA, Tanghe HL, Vincent AJ, Hofman A, Krestin GP, *et al*. Incidental findings on brain MRI in the general population. N Engl J Med 2007;357:1821-8.
11. McCann Dublin AB, Hill RP. The evaluation of seizure disorders by computerized tomography. J Neurosurg 1979;50:328-32.
12. Betting LE, Mory SB, Lopes-Cendes I, Li LM, Guerreiro MM, Guerreiro CA, *et al*. MRI reveals structural abnormalities in patients with idiopathic generalized epilepsy. Neurology 2006;67:848-52.
13. Duncan JS. Brain imaging in idiopathic generalized epilepsies. Epilepsia 2005;46(Suppl 9):108-11.
14. Woermann FG, Sisodiya SM, Free SL, Duncan JS. Quantitative MRI in patients with idiopathic generalized epilepsy, Evidence of widespread cerebral structural changes. Brain 1998;121:1661-7.
15. Wyllie E, Chee M, Granström ML, DelGiudice E, Estes M, Comair Y, *et al*. Temporal lobe epilepsy in early childhood. Epilepsia 1993;34;859-68.
16. Morris HH, Estes ML, Gilmore R, Van Ness PC, Barnett GH, Turnbull J. Chronic intractable epilepsy as the only symptom of primary brain tumor. Epilepsia 1993;34:1038-43.
17. Swartz BE, Tomiyasu U, Delgado-Escueta AV, Mandelkern M, Khonsari A. Neuroimaging in temporal lobe epilepsy: Test sensitivity and relationships to pathology and postoperative outcome. Epilepsia. 1992;33(4):624-34.

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