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COMPUTERIZED TOMOGRAPHY OF CHILDREN WITH SEIZURE DISORDERS

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ABSTRACT

Background: Neuro-imaging is generally considered as part of the evaluation of seizures and epilepsy. There is limited information about its usefulness in our environment. We describe the pattern of CT findings in children with seizures in our environment.

Method: We carried out a retrospective review of the computerized tomography findings in children with recurrent seizures over a one year period, November 2005 to October 2006.

Results: During the study period, 49 infants and children had computerized tomography performed on them out of which 19 had CT done for recurrent seizures. They ranged in age from 4months to 16 years with 13 of them being boys. Generalized tonic - clonic seizures was the most predominant seizure type, being present in 10 of the 19 (52.6%) children while simple partial seizure, myoclonic jerk and mixed seizure types were present in 2 cases each. Abnormal scan was demonstrated in 10 of the 19 children (52.6%) with 3 of them having double cerebral lesions, giving a total of 13 cerebral lesion demonstrated by the CT scan. Cerebral infarct was the most common lesion demonstrated, being present in 5 of the 13 lesions (38.5%). Others were cerebral atrophy in 4 cases (30.8%), moderate ventricular dilatation 2 (15.4%) and 1 each of porencephalic cyst, hydrocephalus and linear skull fracture. Of the 10 children with abnormal scan, 90% of them had significant past medical history, with birth asphyxia (44.4%) and meningitis (33.3%) being the commonest significant past medical history in them.

Conclusion: There is a high incidence of abnormal scan findings in children with seizure disorder in our environment compared to what is obtained from the developed countries. Cerebral infarct appears to be the most common abnormal CT findings in our children with seizures.

Key Words: Tomography, Seizures, Disorders.

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INTRODUCTION:

Computerized Tomography (CT) is a neuroimaging procedure that offers an opportunity to investigate structural lesions as a cause of seizure. CT can be obtained in a few seconds and therefore significantly less sensitive to patient motion which could degrade the quality of the image.^{1, 2} It is also more than sufficient for detecting structural abnormalities of the brain, as such, making it an important neuroimaging tool for children.³

Epileptic seizures are sudden, involuntary behavioural event caused by neuronal hyperexcitability and, generally caused by either structural abnormality of the brain or biochemical aberrations of a metabolite, infection or other physical aetiology.⁴ Although CT is now fairly available in Nigeria, its cost is prohibitive and often

beyond the reach of the common man and as such may not be requested as often as it should in children with seizure disorders.

Of recent our hospital acquired high resolution multidetector CT machine and other imaging modalities and as such, CT became available as a routine neuroimaging study. A review of the indications for and results of this neuroimaging study in children within the first 1 year of its operation in our Hospital showed that 19 children had CT study done on them for recurrent seizures. They form the subject of this review.

MATERIALS AND METHODS

The records of all children 0 - 16 years referred to the Radiology Department for computerized tomography within the first year of operation of the multidetector CT machine in our hospital, November 2005 to October 2006 were reviewed. The case files of all children who had CT done for seizure disorder

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were retrieved from the Medical Records Department and reviewed. Data retrieved were the age and sex of the children, detailed history of seizure which includes age at onset of seizure and type of seizure, detailed past medical history and the result of the CT study carried out on each patient. Computerized Tomography was done using GE LCD 1880 SX 2 slicer high speed machine. The CT procedure includes axial slices of the brain obtained at 5mm cut from the base of the brain to the vertex. Pre and post contrast slices were obtained. Reformation and 3D images were also obtained where necessary. All the CT reports and findings were reviewed by the Consultant Radiologist. Seizure was classified based on the 1989 International League Against Epilepsy (ILAE) classification of epilepsy and seizure disorder.⁵ The data was analyzed using simple arithmetic method. The frequencies of each CT findings were represented as percentages.

RESULTS

During the study period, 418 computerized tomography scans were performed on all categories of patients at the Radiology department, out which 49 (11.7%), were performed on infants and children. Out of these 49 children, 19 had CT done on them because of recurrent seizures. There were 13 boys and 6 girls. They ranged in age from 4 months to 16 years. Generalized tonic Clonic seizures was the most predominant seizure type, being present in 10 of the 19 (52.6%) children while simple partial seizure, myoclonic jerk and mixed seizure types were present in 2 cases each. In the remaining 3 cases, the seizures types were generalized clonic, atonic seizure and partial seizure secondarily generalized respectively. This is presented in the table below.

Abnormal scan was demonstrated in 10 of the 19 children (52.6%) with 3 of them having double cerebral lesions, giving a total of 13 cerebral lesion demonstrated by the CT scan. Cerebral infarct was the most common lesion demonstrated, being present in 5 of the 13 lesions (38.5%). Others were cerebral atrophy in 4 cases (30.8%), moderate ventricular dilatation 2 (15.4%) and 1 each of porencephalic cyst, hydrocephalus and linear skull fracture. The seizure type among these with abnormal scan was GTC in 5(50%), myoclonic jerk and mixed seizure type in 2 cases each (20%) and in the remaining 1 case, the seizure type was simple partial seizure. Of the 5 children with cerebral infarct as the main CT findings, 2 had myoclonic jerk (one with infantile spasm) while 1 case each had GTC, simple partial and mixed seizure types respectively.

When the antecedent histories of these children were considered, 9 out of 10 (90%) children with abnormal CT scan had significant past medical

history, with histories suggestive of birth asphyxia (44.4%) and meningitis (33.3%) being the commonest significant past medical history in them. Among the 9 children with normal scan, 6 (66.7%) had significant past medical history. In this group, a history suggestive of metabolic injury following bilirubin encephalopathy was the most common event documented (50% of cases). Considering the age of onset of seizures, 8 of the 19 children (42.1%) had their seizure beginning within the first year of life with 3 of them within the first one month of life. Of these 8 children, 5 (62.5%) had abnormal scan compared to 5 of the 11 children (45.5%) whose seizures began after 1 year of age.

Table 1: Clinical Types of Seizures in the 19 Children with Seizure Disorders.

Type of Seizure	No.	%
Generalized Tonic Clonic Seizure	10	52.6
Simple Partial Seizure	2	10.5
Myoclonic Jerks	2	10.5
Partial Seizure	1	5.3
Secondarily Generalized Generalized Clonic Seizure	1	5.3
Generalized Atonic Seizure	1	5.3
Mixed Seizure Type	2	10.5
Total	19	100

DISCUSSION

The low scan rate of 19 per year for children with seizure disorder in our environment may not be unconnected with the fact that this neuroimaging facility is new in our environment as well as the apparent high cost of this procedure. It cost about 100USD, which is about twice the average monthly income of a greater population of Nigerians (minimum basic monthly salary less than 50USD). The low scan rate and the prohibitive cost of the study was also highlighted by Obajimi et al² from Ibadan, South Western Nigeria, where a CT scan study cost about 150USD. In that center, over a 5 year period, 103 CT scan were done for children with seizure disorder, an average of 20 scan per year, a situation that is different from what is obtained in developed countries.⁶

This small series have shown that as much as 52.6% of children with seizure disorder in our environment will have an abnormal neuroimaging studies using the CT scan. Our findings is similar to the series reported by Obajimi et al² from Ibadan, western part of Nigeria, where the prevalence of abnormal CT scan in children with seizure was reported to be

51.5%. This is however much higher than the 12.7% and 21% reported by Berg et al⁷ and Shinnar et al⁸ respectively who studied children with an apparent first unprovoked seizure and the range of 30%^{9,10} to 33%⁶ described by other authors who studied children with chronic seizure disorder. In other series that studied a mixed population of children and adult, the frequencies of abnormal CT scan were reported to be as high as 61%.^{11,12} However, even in this series of mixed population, the observations were that the prevalence of abnormal scan were much higher in the older population (73% in patients >20 years) compared to younger patients (13% in patients under the age of 10 years). Most of these reports were described in Caucasians.

What is apparent from these various reports is that the rates of abnormal CT scan in children with seizure disorders is likely to be lower among children from the developed countries⁶⁻¹⁰ compared to children from tropical countries as is observed in our study and that of Obajimi et al from western part of Nigeria.² The reasons for this difference in the abnormal scan rate are not quite clear. However, as was observed by Obajimi et al,² CT scan done for seizure with antecedent history of cerebral infection and trauma were of greater yield compared to scans done only on account of seizure alone. In our study, 90% of children who had abnormal scan had significant past medical history with histories suggestive of, birth asphyxia and cerebral infections, contributing over 77% of these significant antecedent events compared to children with normal scan in whom a history suggestive of metabolic injury following bilirubin encephalopathy was the most common antecedent event documented (50% of cases). The prevalence of trauma, infection and infestations are more in countries of the tropical region compared to the developed countries.¹³ Therefore, it is likely that these differences in the regional rates of trauma and infections may contribute to the observed differences in the abnormal scan rate of children with seizure disorders from these regions. The study has also shown that CT scan is more likely to be abnormal in children whose seizures began within the first year of life compared to those whose seizures began after the first year of life. Of the 8 children whose seizures began within the first year of life, 62.5% of them had an abnormal scan compared to those whose seizures began after one year of life (45.5%). Similar findings have been reported by other authors.^{2,6,8} Obajimi et al² obtained 63.6% abnormal scan rate in children whose seizures started within the first year of life while 100% of all children whose seizures started in the neonatal period had an abnormal scan in the study by Yang et al.⁶ The youngest patient in this report was a 4 month old girl who was delivered after a prolonged labour with birth asphyxia and started

Convulsing since the 3rd day of life. The seizure type is classified as partial seizures secondarily generalized. Her CT showed moderate dilatation of the lateral ventricles with left temporal lobe cerebral infarct.

The most common abnormal CT finding in our study was cerebral infarct, which was found in 38.5% of the abnormal scan findings closely followed by cerebral atrophy in 30.8% of the lesions. This is different from what is obtained from western part of the country where dilated ventricles and hydrocephalus were the most common abnormal CT findings in children with seizure disorders.² Also in other studies from the developed countries, cerebral atrophy was the most common abnormal CT findings in children with seizure disorders^{9,10} while Shinnar et al⁸ reported that focal encephalomalacia including old infarct was the most common abnormal scan findings in their own series.

In conclusion, while we have shown that there is a low scan rate for children with seizures disorders, there is a high incidence of abnormal CT findings among children with seizures in our environment compared to what is obtained in the developed countries.

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