Correlation of Brain MRI Findings with Anthropometric Variables in Paediatric Patients with Seizure Disorder at Aminu Kano Teaching Hospital, Kano, Nigeria

Original Article

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ABSTRACT

Background: Seizures are common neurological emergencies seen in paediatrics, and MRI is the preferred imaging modality for identifying underlying structural lesions. Anthropometric variables affect growth and neurodevelopment. However, its relationship with MRI abnormalities in paediatric seizure populations has not been well described in the study area.

Aim and Objective: To determine the pattern of MRI brain findings in paediatric patients with seizure disorder and assess their relationship with anthropometric variables.

Methods: A prospective cross-sectional study was conducted at the Radiology unit of Medserve Kano Diagnostic Centre within Aminu Kano Teaching Hospital, seventy-one paediatric patients aged 0-17 years who underwent brain MRI for seizure evaluation were included. Participants with psychiatric illness, substance-related seizures, lacked clinical evidence of seizure, older than 17 years, were excluded. Demographics and Anthropometric measurements were obtained using standard methods. MRI findings were categorized as normal or abnormal and further described by lesion type. Data were analyzed using SPSS version 26, and descriptive and inferential statistics were used to summarize the findings.

Results: Of the 71 participants, 45 (63.4%) were male and 26 (36.6%) were female. Fifty patients (70.4%) had abnormal MRI findings and 21 (29.6%) had normal studies. Male participants had a higher mean MRI rank than females (38.37 vs 30.34), but the difference was not statistically significant (p=0.108). Cerebral atrophy was the most frequent abnormality, followed by encephalomalacia. MRI findings demonstrated a weak negative correlation with age, while associations with anthropometric variables were weak and not statistically significant.

Conclusion: Abnormal MRI findings were common in pediatric seizure patients, predominantly cerebral atrophy and encephalomalacia. Anthropometric measures showed no statistically significant association with MRI abnormalities, except for a weak negative relationship with age.

Keywords: paediatric seizure, magnetic resonance imaging, anthropometric variables.

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Introduction

Seizures are among the most frequent neurological presentations in childhood and account for substantial emergency visits, inpatient admissions, and specialist referrals [1]. They may arise from a broad range of causes, including congenital brain malformations, perinatal hypoxic-ischaemic injury, intracranial infection, metabolic derangement, trauma, tumour, vascular lesions, and acquired white matter damage [2,3]. Because seizure semiology alone may not reveal the underlying cause, structural neuroimaging plays an important role in defining disease mechanisms, estimating prognosis, and guiding further management [4].

Magnetic resonance imaging (MRI) is regarded as the imaging modality of choice in paediatric seizure evaluation because it offers superior soft tissue contrast, multiplanar capability, and excellent sensitivity for subtle cortical and white matter abnormalities without exposure to ionising radiation [4,5]. Previous studies by [6-10] have described a wide spectrum of MRI abnormalities in paediatrics with epilepsy or seizure disorder, including encephalomalacia, cerebral atrophy, malformations of cortical development, periventricular leukomalacia, mesial temporal sclerosis, hydrocephalus, and neoplastic lesions. The burden and pattern of these abnormalities vary across settings, probably reflecting differences in referral pathways, infectious disease prevalence, neonatal care, and access to advanced neuroimaging [3].

Anthropometric assessment is also central to paediatric practice. Age, height, weight, and head circumference provide simple but clinically meaningful markers of growth, nutrition, and neurodevelopment [2,5]. Head circumference in particular is closely linked to brain growth in infancy and early childhood, and abnormal values may indicate microcephaly, macrocephaly, hydrocephalus, or developmental brain disturbance [5]. Stunting, underweight, or poor growth trajectories may likewise reflect chronic disease or early life insults that can affect neurodevelopmental outcomes [11]. Although MRI findings and anthropometric measurements are both clinically important in paediatrics with seizures [12], few studies have attempted to relate them directly. It remains unclear whether paediatrics with abnormal anthropometric variables is more likely to demonstrate structural MRI abnormalities, or whether anthropometric variables have limited predictive value once seizure disorder is established. This gap is particularly evident in Nigerian and broader West African literature, where most studies have focused on MRI lesion patterns in seizure patients rather than anthropometric correlation [6].
This study was therefore aimed to determine MRI brain findings among paediatric patients with seizure disorder at Aminu Kano Teaching Hospital, Kano, Nigeria, and to assess whether MRI findings were associated with age, height, weight, and head circumference. By addressing this question, the study sought to provide locally relevant evidence for the clinicians involved in seizure evaluation and management.

Methods

The study was prospective and cross-sectional undertaken at the Radiology Unit of Medserve Kano Diagnostic Centre situated within Aminu Kano Teaching Hospital, Kano, Nigeria. The center provides MRI and other diagnostic imaging services for patients referred from the teaching hospital and surrounding facilities. The study population comprised paediatric patients aged 0-17 years who presented with seizure disorder and underwent brain MRI during the study period. Paediatrics with clinical histories of any seizure type were eligible. Exclusion criteria were psychiatric or mental illness, seizure attributable to drug or substance use, absence of clinical evidence supporting seizure or epilepsy on review, age above 17 years, and refusal to participate. All eligible patients encountered during the study period were included; therefore, separate sampling and sample size calculation were not performed.

Primary data were collected directly from participants and caregivers using a data capture sheet. Demographic information, seizure history, and relevant clinical background were obtained from caregivers and clinical records. Anthropometric variables measured were age, height, weight, and head circumference. Head circumference was measured with a non-stretch measuring tape placed above the glabella, around the ears, and over the

occiput. Height was measured supine in infants and non-ambulatory patients, and with a stadiometer in patients able to stand upright. Weight was measured using age-appropriate weighing procedures, including caregiver-assisted subtraction method for infants where necessary.

Brain MRI was performed with a 1.5 Tesla Siemens Magnetom Essenza system using a head coil and dedicated paediatric seizure protocol. The protocol included localizer images followed by sagittal T2, axial FLAIR, axial T2, axial diffusion-weighted imaging, coronal oblique FLAIR, coronal T1 Turbo Inversion recovery (TIR), axial T1, axial gradient-recalled acquisition, and post-contrast T1-weighted imaging when clinically indicated. Sequence planning was based on standard brain orientation and hippocampal alignment for seizure evaluation. MRI examinations were then classified as normal or abnormal. Abnormal studies were further described according to the dominant imaging diagnosis reported, including cerebral atrophy, encephalomalacia, hydrocephalus, demyelination, tumour, infarct, congenital anomaly, mixed lesion combinations, and other structural abnormalities.

Descriptive and inferential statistics were obtained using SPSS version 26. Statistical significance was set at $p<0.05$. Ethical approval was obtained from the Human Research and Ethics Committee of Aminu Kano Teaching Hospital. Written informed consent was obtained from parents or guardians before data collection and imaging procedures.

Results

A total of 71 paediatric patients were included in the study. Males accounted for 63.4% (n= 45) participants and females 26 (36.6%) as shown in figure 1. Table 1 shows the mean and standard deviation of age, height, weight and head circumference for both genders. Figure 2 shows the distribution of seizure episodes among the study population. The majority of patients 58% presented with more than three seizure episodes, followed by 23% with three episodes, 10% with two episodes, and 9% with a single episode. Table 2 shows the list of MRI findings where abnormal MRI findings are found in 50 patients (70.4%) and normal findings in 21 patients (29.6%), indicating that approximately seven out of every ten paediatric patients had detectable structural abnormalities. Among the abnormal MRI findings, cerebral atrophy was the most common pathology, observed in 18 patients (36.0%), followed by encephalomalacia in 12 patients (24.0%).

Other findings included hydrocephalus in 5 patients (10.0%), demyelination in 3 patients (6.0%), cerebral infarction in 3 patients (6.0%), cerebral haematoma in 2 patients (4.0%), posterior fossa cystic dilatation in 2 patients (4.0%), porencephalic cyst in 1 patient (2.0%), ring-enhancing lesion in 1 patient (2.0%), tumour in 1 patient (2.0%), and hypoxic-ischaemic encephalopathy in 1 patient (2.0%). Mixed abnormalities, including combinations of cerebral atrophy with encephalomalacia and infarction, were observed in 1 patient (2.0%). The distribution of MRI abnormalities shows no statistically significant difference between male and female patients ($p = 0.108$), despite a higher mean rank observed among males. Correlation analysis showed weak negative associations between MRI findings and all anthropometric variables among males and a similar pattern was observed among females.

In the overall analysis, MRI findings demonstrated a weak but statistically significant inverse correlation with age ($r = -0.235$, $p = 0.048$). However, correlations with height, and head circumference remained weak and not statistically significant.

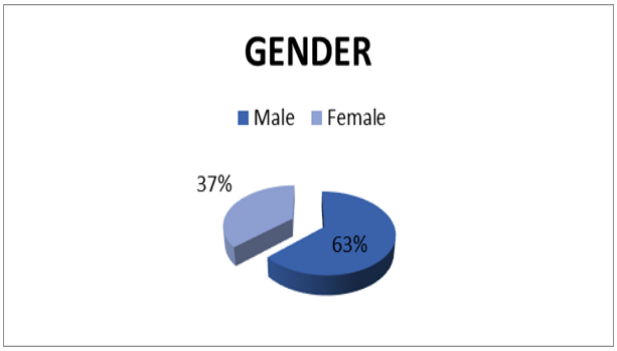

Fig 1: Gender distribution

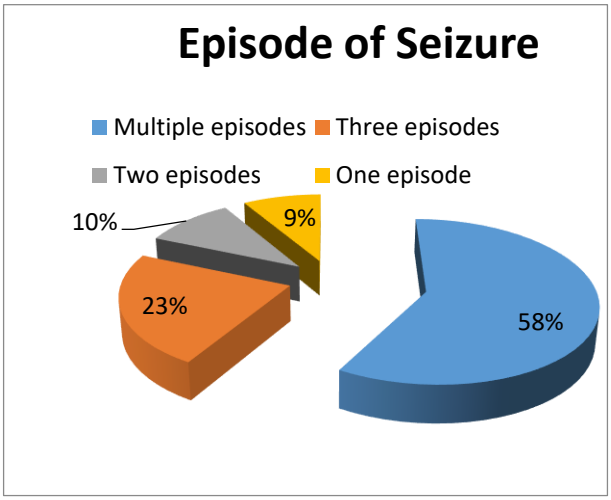

Fig 2: Distribution of the episode of seizure in paediatrics age group

Table 1: Anthropometric variables of the selected subjects

Gender	Age (yrs), Mean ± SD	Height (cm), Mean ± SD	Weight (kg), Mean ± SD	HC (cm), Mean ± SD
Male	5.94 ± 5.77	93.82 ± 38.27	17.91 ± 15.82	46.16 ± 8.21
Female	7.28 ± 6.31	103.08 ± 36.71	21.92 ± 17.75	51.25 ± 13.28
Total	6.43 ± 5.97	97.21 ± 37.71	19.38 ± 16.54	48.03 ± 10.56

Table: 2: Distribution of MRI finding among the paediatrics patients

SN	MRI Findings	Male n (%)	Female n (%)
1	Normal Study (NS)	11 (24.4)	10 (22.2)
2	Cerebral Atrophy (CA)	6 (13.3)	5 (11.1)
3	Encephalomalacia	5 (11.1)	–
4	Hydrocephalus	2 (4.4)	–
5	Demyelination	–	2 (4.4)
6	Posterior Fossa Cystic Disease (PFCD)	1 (2.2)	–
7	Cerebral Hematoma	2 (4.4)	–
8	Cerebral Ring Enhancing Lesion	1 (2.2)	–
9	SVCID	1 (2.2)	2 (4.4)
10	Cerebral Tumor	1 (2.2)	–
11	Cerebral Infarct	–	2 (4.4)
12	NECL	–	1 (2.2)
13	White Matter Lesion	1 (2.2)	–
14	Cerebral Atrophy & Encephalitis	–	1 (2.2)
15	ACM & Hydrocephalus	–	1 (2.2)
16	PGT & Hydrocephalus	2 (4.4)	–
17	Porencephalic Cyst & Cerebral Atrophy	1 (2.2)	–
18	Cerebral Infarct & Cerebral Atrophy	3 (6.7)	–
19	Encephalomalacia, Cerebral Atrophy & HIE	1 (2.2)	–
20	CREL & Blake Cyst	1 (2.2)	–

SN	MRI Findings	Male n (%)	Female n (%)
21	Encephalomalacia & Cerebral Atrophy	1 (2.2)	1 (2.2)
22	AH & Schizencephaly	1 (2.2)	–
23	Encephalomalacia, Cerebral Atrophy	1 (2.2)	–
24	NICA & SVID	1 (2.2)	–
25	Cerebral Atrophy & SVII	–	1 (2.2)
26	Cerebral Infarct & Encephalomalacia	1 (2.2)	–
27	HIE & Cerebral Atrophy	1 (2.2)	–
Total		**45 (63.4)**	**26 (36.6)**

DISCUSSION

This study assessed the spectrum of brain MRI findings in paediatric patients presenting with seizures and examined their association with selected demographic and anthropometric variables. The results demonstrated a high prevalence of abnormal MRI findings, with 70.4% of patients showing structural abnormalities. This is consistent with several previous studies that reported a higher proportion of abnormal neuroimaging findings among paediatrics with seizures [6-10,14-16]. However, some studies have reported a higher proportion of normal MRI findings [17,18]. This may be attributed to differences in study design, population, patient selection criteria, age distribution, seizure classification, timing of imaging, availability of dedicated epilepsy imaging protocols, regional and etiological factors. This supports the established role of MRI as a valuable diagnostic tool in identifying underlying structural causes of seizures in paediatric population.

Among the MRI-positive cases, cerebral atrophy was the most common finding, followed by encephalomalacia. This pattern is in agreement with findings reported by [17, 21]. However, other studies have reported different leading findings, including hydrocephalus[6],hypoxic-ischemic encephalopathy [9,19], infections such as tuberculosis [20,10], and encephalomalacia [18]. These variations highlight the heterogeneity of seizure aetiology in paediatrics and suggest that regional factors, including the burden of perinatal insults and infectious diseases, may influence neuroimaging patterns. The least frequent findings in this study included hydrocephalus and cerebral hematoma, which is consistent with reports by [10, 19]. However, other studies have reported different rare findings such as hemi-megalencephaly [21], encephalitis /encephalopathy[17], polymicrogyria [7], space-occupying lesions [8], and pyogenic abscess [22]. These differences further emphasize the variability in less common MRI findings across populations and clinical settings.

Although the proportion of normal MRI findings in this study were lower than that of abnormal findings, it remains clinically significant, as a normal MRI does not exclude epilepsy or seizure disorders [24]. Seizures may arise from functional, metabolic, genetic, or microstructural abnormalities that are not detectable on conventional imaging, and several studies have shown that a substantial proportion of paediatrics with epilepsy may have normal MRI findings despite clear clinical seizure activity [1,4]. This is particularly common in idiopathic or genetic epilepsies, metabolic disorders, and early-stage neurological conditions where structural changes are either absent or below the resolution of standard MRI techniques [6]. Additionally, advanced imaging modalities such as functional MRI, diffusion tensor imaging, and positron emission tomography can reveal abnormalities not visible on routine MRI, highlighting its limitations in certain contexts [4].

Therefore, normal MRI findings should be interpreted cautiously and in conjunction with clinical evaluation and, where available, electroencephalography (EEG) [24]. Despite these limitations, MRI remain a key diagnostic tool in paediatric seizures, particularly in resource-limited settings for identifying structural abnormalities that guide clinical management and prognosis [3,6,14]
This study found no statistically significant difference in MRI findings between male and female patients, indicating that gender does not appear to influence the distribution or pattern of structural brain abnormalities in paediatric seizures [7,10].

Although a higher proportion of males was observed in the study population, the type and burden of MRI abnormalities were comparable between both sexes. This finding is consistent with most of the previous studies that reported no significant gender-related differences in seizure characteristics [6,8,23]. In contrary, some studies have reported a higher overall incidence of seizures in males [20,21] which is often attributed to increased vulnerability to perinatal and environmental risk factors. However, these differences generally relate to seizure occurrence rather than the distribution of structural brain abnormalities. Clinically, this suggests that imaging decisions and the level of radiologic suspicion should be applied equally to both genders presenting with seizures.

This study found no statistically significant correlation between MRI findings and anthropometric variables. The only statistically significant association in the pooled sample was the weak inverse relationship with age. Even this finding should be interpreted cautiously because the effect size was small and may reflect distributional characteristics of the sample rather than a clinically strong biological relationship. To the best of our knowledge, there is limited published literature directly examining the relationship between anthropometric indices and MRI abnormalities in paediatric seizures. Although anthropometric measures are widely used indicators of nutritional and general health status [25] their lack of association with neuroimaging findings in this study suggests that structural brain abnormalities in paediatrics with seizures may occur independently of somatic growth parameters [26].

Although measures such as weight, height, and head circumference are widely used indicators of nutritional status and general health [12,25], they may not accurately reflect underlying neuropathological changes detectable on neuroimaging. One possible explanation is that many of the abnormalities identified, such as cerebral atrophy, encephalomalacia, and congenital malformations, are primarily influenced by factors such as perinatal injury, infections, and developmental abnormalities rather than current anthropometric status [27].

Conclusion

This study demonstrated that brain MRI reveals a wide range of structural abnormalities in paediatric patients with seizures, with cerebral atrophy and encephalomalacia being the most common findings. The lack of statistically significant association between MRI findings, gender and anthropometric variables suggests that growth parameters have limited value in predicting structural brain pathology in this population. Overall, these findings support the routine use of MRI in the evaluation of paediatric seizures, particularly in settings where structural causes are common, and emphasize the need for clinical assessment to guide imaging decisions.

Limitations of the Study

Electroencephalography (EEG) was not performed, which may have limited comprehensive classification of seizure types and their correlation with MRI findings. Additionally, the relatively small sample size may have reduced the statistical power to detect subtle associations and limited stratification across all paediatric age groups. Future studies incorporating larger sample sizes and multimodal assessment are recommended.

Conflict of Interest: The authors declare that they have no conflict of interest.

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