

Complications and Identification of Risk Factors Related to Seizures in Children Under the Age of Ten

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Abstract:

Background: Abnormal electrical activity in the brain causes seizures in children, which result in temporary changes in behaviour, awareness, and movement of the body.

Objective: This study aimed to identify clinical outcomes of risk factors and complications into children with seizures.

Patients and methods: A cross-sectional study was conducted in different hospitals in Iraq between March 2022 and October 2023, involving 80 children aged 1-14 years who had an acute onset of seizures. The study excluded patients who were not known epileptic patients, those with known intracranial pathology, and those with psychogenic non-epileptic seizures. Demographic details, clinical description of the attack, duration, and other symptoms were collected. Data on febrile convulsions or epilepsy histories and family members affected by seizures were also collected. Our study also determined complications, risk factors, and quality of life evaluation.

Results: The study found that children aged 1-4 years had the highest number of seizures, with males having the highest percentage at 70%. Comorbidities were also prevalent, with a family history of seizure at 25%. Medications used were 45%, and nutritional status was normal at 72 cases, while malnutrition had 8 cases. Common causes of seizures included febrile seizures, malaria, and meningitis. Medical symptoms included fever, pallor, vomiting, and headache. Diagnostic techniques used included ultrasound, CT scan, and MRIs. Seizure types included focal and generalized, with attacks lasting ≤ 15 minutes. Clinical outcomes included mortality rate, intensive care unit admission, anxiety or depression, developmental delays, and physical injuries. Quality of life evaluations showed physical, psychological, emotional, social, and daily activity aspects. Risk factors for seizures included age, sex, family history, seizures, febrile seizures, malaria, meningitis, fever, pallor, types of seizures, duration of attacks, anxiety or depression, physical injuries, and developmental delays. **Conclusion:** Younger children had more seizures compared to older children. The development of status epilepticus could be independently associated with either fever or any focal seizure; this was because a combination of fever and febrile seizures acted as risk factors for status epilepticus. Death was more likely among children with both meningitis and status epilepticus.

Keywords: Seizures; Children; Complications; morbidity and mortality; and Risk factors.

Introduction

Seizures are common in paediatric admissions and often lead to neurological and cognitive problems that are common in children [1]. Currently, many researchers use the term epileptic seizure instead of convulsion, even though it is rare or occasional, and the prevalence of convulsions in children under ten years of age is high. [2 – 4]

Seizures account for 2% of all hospitalisations in the United States. Their incidence is much higher in tropical countries, particularly in sub-Saharan Africa, where infections of the central nervous system account for 80% of cases, with a variety of aetiologies. The prognosis of each case depends on the cause of the pathology and the severity of the seizures. [5 – 8]

In most cases, the spasm is simple and benign. It is more common in children under the age of five in the more acute and febrile forms [9]. A detailed clinical examination, laboratory tests, and imaging studies are necessary to determine the aetiology. Computed tomography scans are not used unless there is a suggestive clinical history or in cases of persistently impaired consciousness. The main problem in these countries is the financial cost of these investigations. [10 – 14]

Even though it can lead to family anxiety, long hospitalization, and death, among other things, a wrong diagnosis has more risk [15]. The risk of severe brain palsy, epilepsy, and death is always higher for seizures, but the determining factors are probably their causes in relation to the brain damage's extent as opposed to the seizure itself. [16]

A seizure is an abnormal brain activity that ends in behavioral, sensory, perceptual, or motor activity [17]. There are four major types of seizures depending on where they initially start. Seizures make up 5% of the global disease burden, affecting everyone irrespective of their age, race, economic status, and geographical location [18]. Epilepsy affects more than three million Americans of all ages in the United States [19]. It is estimated that more than 200,000 new cases occur within a year. Each year,

nearly half of these events, or 40–50 percent, are usually recurrent and can be called epilepsy seizures [20, 21]. Seizures are one of the main causes of neurological morbidity in children due to epilepsies, according to the 2008 World Health Organization country report [22]. From birth to 15 years of age, the average annual incidence of epilepsy is around 5-7 per 10,000 children [23]. Seizures, unfortunately, remain a problem for many Americans – by whom over 3 million citizens are affected despite their age range [24]. This figure increases by about 200k each year, with 40-50% relapsing into epileptic conditions after the initial event occurred. It, therefore, means that more children suffer due to epilepsy cases among them, which culminate in various neurological complications at large, including, for example in, developmental delays not forgetting about sudden infant death syndrome (SIDS) know all over the world; typically, from day one during their entire 15 years of life has five to seven epilepsy related incidences with every ten thousand kids born every year. [25 – 29]

A medical problem that affects many children is seizures, which are considered the most common chronic neurological condition among children in all economic classes. Ranging from mild to potentially fatal, childhood epilepsy syndromes are common [30]. Various reasons, such as infection, severe brain injury, and anatomical malformation, among others, can lead to the occurrence of seizures in children [31]. In high-income countries, the highest prevalence of pediatric seizures is observed in the youngest age groups [32]. Although the majority of these patients had no known putative risk factors, newly diagnosed pediatric seizures were significantly associated with neonatal seizures, central nervous system (CNS) infections, and childhood static encephalopathy. [33]

Patients and methods

A cross-sectional study was carried out in the wards of a Baghdad-based hospital between March 2022 and October 2023. The children's units in all hospitals have pediatric general wards, intensive care units, and observation wards. Within 24 hours of hospitalization, the hospitals recruited 80 children aged 1-14 years who had an acute onset of seizures. Other patients excluded were those who presented with seizures but were not known epileptic patients, neither were they on antiepileptic medications; those who had known intracranial pathology such as patients who are followed up for cerebral palsy or space-occupying lesions; and those with psychogenic non-epileptic seizures, defined by altered movement sensations or experience, the study did not involve exclusion of patients that suffered from such affection as pseudoseizures (they're like epilepsy, but they occur under certain psychological conditions). Besides that, demographic details, clinical description of the attack features, its duration, and other symptoms like fever, cough, diarrhea, vomiting, and headache all these were collected. Information on the histories about febrile convulsions or epilepsy was taken for each individual who participated; also, data concerning family members who had been affected by seizures were provided along with relevant details about their condition. Upon admission and discharge, a detailed clinical examination that involved vital observations, anthropometric measurements as well as systems examination focusing on neurological assessment was done. At a daily basis, these children's activities were monitored until they either died or left the hospital. It must, however, be noted that status epilepticus is defined as continuous seizure activity or recurrent episodes of seizures lasting over thirty minutes without regaining consciousness. In this investigation, malaria was considered when test results for RDT were positive or milestones indicated observation of falciparum malaria. All patients coming from or that have been to malaria areas or those suspected to have malaria, RDT, and or MPs were done to them. When the patient had meningitis or encephalitis

on clinical grounds or owing to cerebrospinal fluid results, then it was the final diagnosis recognised with certainty. Fever cerebritis indicators such as irritability, bulging fontanelles, separated sutures, and neck stiffness were signs for meningitis. Lumbar puncture was done on cases that seemed to have meningitis.

Hypertensive encephalopathy was thought of as a diagnosis when other causes had been ruled out in a child whose blood pressure readings were (systolic and diastolic) above the 95th percentile and when antihypertensive medications were required for treatment to be made. According to ILAE (1993), epilepsy was described as two unprovoked seizures, or more, with or without EEG evidence, for a prior seizure, hemiplegia/hemiparesis (focal deficit) lasting more than 24 hours was taken as indicative of a stroke diagnosis. This study used SPSS for Windows Version 22.0 to analyse clinical and demographic data. They used standard descriptive statistics, such as means and medians, to summarize socio-demographic characteristics; this included interquartile ranges for continuous variables as well as proportions for categorical variables. A study was done using multiple logistic regression analysis to find study factors that are associated with status epilepticus and or death, with a significance level of $p < 0.25$, which was obtained from bivariate analyses. For every analysis regarding this study variable, statistical significance was tested at $p < 0.05$ (two-sided).

Results

Table 1: Clinical and demographic characteristics of patients.		
Characteristics	Number of patients [80]	Percentage [%]
Age		
1 – 4	44	55%
5 – 9	20	25%
10 - 14	16	20%
Sex		
Male	56	70%
Female	24	30%
BMI, [kg / m ²]		
Underweight	6	7.5%
Normal weight	22	27.5%
Overweight	18	22.5%
Obesity	34	42.5%
History of seizure		
Yes	30	37.5%

No	50	62.5%
Family history of seizure		
Yes	20	25%
No	60	75%
Medications used		
Yes	36	45%
No	44	55%
Comorbidities		
Yes	48	60%
No	32	40%
Hypertension	32	40%
Diabetes	16	20%
Obesity	20	25%
Asthma	12	15%
Kidney diseases	4	5%
HIV	8	10%
Nutritional status		
Normal	72	90%
Malnutrition	8	10%

Table 2: Identifying the main causes of seizures occurring in 80 children.		
Causes	Number of patients [80]	Percentage [%]
Febrile seizures	52	65%
Malaria	8	10%
Meningitis	7	8.75%
Hypertensive encephalopathy	4	5%
Hypoglycemia	5	6.25%
Others	4	5%

Table 3: Determine the symptoms related to seizures in children.		
Symptoms/signs	Number of patients [80]	Percentage [%]
Fever	68	85%
Pallor	24	30%
Respiratory distress	12	15%
Dehydration	12	15%
Hepatomegaly	11	13.75%
Motor deficit	5	6.25%
Splenomegaly	4	5%
Meningeal syndrome	4	5%
Vomiting	20	25%
Headache	12	15%
Bulging fontanel	2	2.5%

Table 4: Diagnoses outcomes of seizures in children.		
Variables	Number of patients [80]	Percentage [%]
Techniques used		
Ultrasound	72	90%
CT scan	48	60%
MRIs	24	30%
Types of seizures		
Focal seizure	20	25%
Generalized seizure	60	75%
Duration of the attacks		
≤ 15 minutes	72	90%
> 15 minutes	8	10%
Level of severity		

Mild	14	17.5%
Moderate	22	27.5%
Severe	44	55%

Table 5: Clinical outcomes of patients in terms of complications, mortality rate, admission to the intensive care unit, treatment response, and complications.

Variables	Number of patients [80]	Percentage [%]
Admission to the intensive care unit		
Yes	28	35%
No	52	65%
Mortality rate		
Yes	12	15%
No	68	85%
Complications		
Developmental delays	8	10%
Learning difficulties	6	7.5%
Behavioral problems	6	7.5%
Anxiety or depression	15	18.75%
Physical injuries	10	12.5%
Side effects of medications	7	8.75%
Total	52	65%

Table 6: Assessment of quality of life-related to seizures in children.

Items	QoL scores
Physical aspect	34.66 ± 3.10
Psychological aspect	30.89 ± 5.54
Emotional and social aspects	42.25 ± 4.84
Dailly activity	45.82 ± 3.92

Table 7: A multiple logistic regression analysis of risk factors whose impact related to seizures in children.		
Risk factors	OR	CI % 95
Age [1 – 4]	2.5	0.82 ± 6.6
Sex [males]	3.8	1.1 ± 8.9
Family history of seizure	3.0	1.2 ± 4.4
Febrile seizures	4.6	1.6 ± 6.2
Malaria	5.8	2.4 ± 6.7
Meningitis	3.7	2.1 ± 7.4
Fever	3.8	2.0 ± 10.8
Pallor	2.9	2.1 ± 9.9
Types of seizures [Generalized seizure]	3.5	2.9 ± 4.1
Duration of the attacks [$\leq$ 15 minutes]	2.6	1.8 ± 5.4
Anxiety or depression	3.2	1.5 ± 6.4
Physical injuries	2.2	1.7 ± 2.8
Developmental delays	2.6	2.4 ± 8.8

Discussion

This study showed that children with age (1 - 4) years were the highest, having 55% of the cases; males were the greatest percentage with 70%, compared to females had 30%; the rate of comorbidities was 60%, family history of seizure had 25%, medications used was 45%, nutritional status included normal with 72 cases while malnutrition with 8 cases.

Furthermore, the most common causes of seizures that are prevalence in children are febrile seizures, got 52 cases; malaria got, 8 cases; and meningitis got, 7 cases. Also, we identified medical symptoms, which were found: fever was 68 cases, pallor was 24 cases, vomiting was 20 cases, and headache was 12 cases. According to diagnoses results of seizures in children, techniques used included ultrasound had 72 cases, CT scan had 48 cases, and MRIs had 24 cases; types of seizures included focal seizure had 20 cases, the generalised seizure had 60 cases, duration of attacks $\leq$ 15 minutes was 90% cases and attacks $>$ 15 minutes was 10% cases.

In addition, we recorded clinical outcomes, which included mortality had, 12 cases; admission to the intensive care unit had, 28 cases; the most common complications prevalent in children were anxiety

or depression was, 15 cases; developmental delay got, 8 cases; and physical injuries had 10 cases. In terms of quality-of-life evaluation, we found that the physical aspect was 34.66 ± 3.10 , the psychological aspect was 30.89 ± 5.54 , the emotional and social aspects were 42.25 ± 4.84 , daily activity was 45.82 ± 3.92 . Also, the risk factor affected in children, age [1 - 4], sex [male], family history of seizures, febrile seizures, malaria, meningitis, fever, pallor, type of seizures [generalised seizure], duration of seizures [≤ 15 minutes], anxiety or depression, physical injuries, and developmental delay.

There was an American study which suggested that if Antiretroviral Therapy (ART) is given at once, then children who are born with HIV might not get it [32]. The consequence of the PMTCT in Spain can be directly linked to lower percentages of children with HIV but having seizures than a comparable study from South Africa [30]. In other words, it can also be said that infants who get born from mothers that have either been infected or exposed will most likely pass away when they are still very young [32]. In total, 24 (12.6%) children, all of them with a history of febrile seizures, were admitted under the same category, which is a seizure. A known risk factor for convulsion present in infants increases the chance that such a patient may also suffer from a seizure during another point in time [33, 34]. Children whose families have endemic records linked to epilepsy are likely to get affected by this disease in their early age, especially when other factors like fever affect them together [33-35]. Another research points out that the majority of febrile fits are usually generalized tonic-clonic convulsions of short duration <15 minutes, being recurrent in a few instances during the febrile episode [34,35]. It is not clear how common these seizures are in Africa, but most mothers tend to consult traditionalists before taking their children to the hospital because a simple non-caused by fever fit is likely to stop by itself. Meningitis and / or encephalitis were the third most common diagnosis clinically and/or by CSF studies and constituted to 9.4% of the study population. Meningitis and encephalitis are amongst the most prevalent causes of acute symptomatic seizures among young children in the USA and Taiwan [37,38]. In Italian studies carried out on children aged six months up to 15 years, lower figures of status epilepticus were recorded as compared to this research cataloged by [39,40]. The most significant independent risk factors associated with mortality in this study were meningitis and febrile seizures [41]. This is comparable to findings from a Kenyan study, which demonstrated that focal seizures, coma, metabolic acidosis, and bacteremia in combination with pyogenic meningitis and status epilepticus are independently associated with death [42]

Conclusion

The frequency was higher in younger children than in older children, especially in males. The presence of fever or focal seizures was a factor associated with seizures that did not stop. Among children with meningitis, those who had status epilepticus were more likely to die. Febrile seizures in children dominate; despite their high frequency, complex clinical presentation, and management problems, convulsions are generally benign. The care is well codified and closely dependant on the etiology. Prognoses depend as much on their origins as their proper management.

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