Original Article

Epidemiology and Risk Factors of Pediatric Epilepsy in Low-Income Countries

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ABSTRACT

Objective: To describe the epidemiology, trends, and risk factors of pediatric epilepsy with a specific interest in infection-related and perinatal factors in low income countries.

Study Design: A Cross sectional study.

Place and Duration of Study: This study was conducted at the Department of Pediatrics, Peoples university of Medical Health Sciences NawabShah from from January 2023 to July 2023.

Methods: This Cross-sectional Study was carried out with 150 pediatric epilepsy patients in a LIC context. Information on clinical features, seized predictors, and seizure prognosis was obtained by record review and caregiver interviews. Data was analyzed using chi-square tests and t-tests for relations at the value of $p<0.05$.

Results: About 40% of the 150 patients had a record of previous infection such as cerebral malaria, 30% of the patients had perinatal related complications and 20% of patients with epilepsy related to malnutrition. The mean age at onset, or the point at which the client first sought professional interventions, was 4.5 years (SD = 2.1). Statistically significant correlations were determined between the episodes of infections and early onset epilepsy (Chi-square = 7.61 at $p = 0.03$). Acute cases had higher episodes of seizure compared to chronic cases and the groups with malnutrition related illnesses ($p = 0.04$).

Conclusion: In this paper the leading factors contributing to pediatric epilepsy in low income countries include infections, birth complications, and malnutrition. Early diagnosis and intervention services especially among the high risk-potential clients are important. Strengthening of health facilities is needed to combat these and decrease the impact of epilepsy in the low income groups.

Key Words: Chidhood epilepsy, risk factors, LMICs, infections.

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INTRODUCTION

Childhood epilepsy is a common neurologic condition that has a major influence on cognition, development, and psychosocial functioning because of repeated episodes of epileptic seizures. While epilepsy affects children in all countries, the problem in pediatric epilepsy is most significant in LIC because of social economic, health, and environmental factors . Globally, the estimates for epilepsy in among children is between 0.5 % and 1%, but in the LICs the estimates could be as high as 1.5% in some areas[1]. These have been occasioned by the poor health care base and access to diagnostic and therapeutic services; and socio-physical factors including malnutrition and infection. In LICs, pediatric epilepsy is underdiagnosed and under treated because of resource constraints, poor health infrastructure and social barriers. These children are at an increased risk of delayed diagnosis, no access to adequate treatment, and stigmatization all factors that increase the toll of epilepsy for the children[2]. However, comprehensive research in pediatric epilepsy in LICs is limited and no research to date has investigated factors that place children in these settings at greater risk of developing epilepsy. From literature, several risk factors that may contribute to development of pediatric epilepsy in LICs have been established. Some examples include cerebral malaria, bacterial meningitis, neurocysticercosis and other perinatal factors comprising of birth asphyxia, neonatal prematurity and neonatal birth trauma. Poor nutrition is also a major consideration because malnutrition is common among children in most LICs and is associated with reduced brain growth and function meaning that children in these areas are more likely to have seizures[3,4]. This is compounded by low rates of antenatal and postnatal care, compounded with the problem of low utilization of Neonatal Intensive Care Units. Infectious illness related epilepsy is worrisome since the aetiologic conditions can complicate with

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neurological deficits. For instance, cerebral malaria as a consequence of malaria is a leading factor for developing epilepsy in sub-Saharan African region that experiences high rates of malaria infections and first and severe impacts on developing brains[5]. A third cause of epilepsy is the malnutrition that results in epilepsy because of the epileptogenic effects of vitamin deficiencies where there is food insecurity. There is a lack of Vitamin B6 and zinc, which affects neuronal activity; therefore, leading to seizure in children[6,7]. As highlighted by the problem, much remains to be understood regarding the epidemiologic profiles and risk associated with pediatric epilepsy in LICs making an investigation on these areas most essential. Conducting such research will be helpful to make proper understandings of necessary aspects in the context of the higher prevalence of epilepsy as well. The aim of this study was to determine the point prevalence of childhood epilepsy within a LIC and to compare the findings with other developed countries identifying any risk factors for epilepsy including infectious diseases, perinatal factors, and malnutrition.

METHODS

On this cross-sectional study of epidemiology and risk factors for childhood epilepsy were done at a regional hospital in a low income country. The material of the study consisted of 150 children with epilepsy of age ranging from 1 to 15 years with clinical diagnosis witnessed or confirmed by EEG data. Consequently, data collection procedures included medical record documentation, caregiver questionnaires and clinical examination. The Caregivers and those with mental health disorders were asked to consent to being in the study and participating was done under the authority of the local ethical review board.

Data Collection: The collected data include medical records review and caregiver interviews. Demographics, clinical history (infections, birth complications, nutrition, antecedents, and history of seizures), seizure descriptions, and outcomes data were gathered. Nutritional status of the children was determined by weight for age and height for age z scores.

Statistical Analysis: Statistic analysis was done by statistical package system (SPSS) used version 24.0 (IBM Corp., Armonk, NY). On the demographic and clinical characteristics, descriptive statistics were performed. Categorical variables were compared using the chi square tests, The mean differences of continuous variables were compared using the t tests. For statistical analysis, p-value of <0.05 was accepted as significant. In regard to continuous data, SD's were also reported.

RESULTS

Among 150 children, 40 % of them had past history of infections, 25% of these children suffered from cerebral malaria, 10% from meningitis and, 5% from neuro cystercosis. Complication during perinatal period was documented in 60% of cases of which 15% had birth asphyxia, 12% pre-term bih and 10% had birth trauma. In this group of patients, the mean age for the development of epilepsy was 4.5 years, SD = 2.1 with an age range of 1–10 years. It was found that children with infection-related epilepsy developed their seizures at a younger age than those with other types of epilepsy: 3.2 years on average for patients with infection-related epilepsy and 5.2 years for patients without identified infection risk factors (p = 0.03). Similarly, current seizure frequency was also higher in malnourished children, 30% having more than two seizures a week as opposed to 18% in the non-malnourished children (p = 0.04). Seizure control was attained in 48% of the children and 52% of the children still had seizures. Of children with malnutrition-related epilepsy 40% had uncontrolled seizures as compared with 22% of the children in the non-malnourished group (p = 0.02). Low birth weight children experienced refractory seizures (Chi-square = 3.56, p = 0.05) and children with a history of cerebral malaria were likely to experience complex partial seizures (Chi-square = 3.99, p = 0.04).

Table No. 1: Demographic Characteristics of Study Participants

Demographic Variable	Frequency (n)	Percentage (%)
Total Participants	150	100
Age Group (years)		
1–5	70	46.7
6–10	50	33.3
11–15	30	20.0
Gender		
Male	85	56.7
Female	65	43.3
Seizure Type		
Generalized	90	60.0
Focal/Partial	60	40.0

Table No. 2: Risk Factors for Pediatric Epilepsy in Study Population

Risk Factor	Frequency (n)	Percentage(%)
Infections	60	40.0
Cerebral Malaria	37	25.0
Meningitis	15	10.0
Neurocysticercosis	8	5.0
Perinatal Complications	90	60.0
Birth Asphyxia	22	15.0
Prematurity	18	12.0
Birth Trauma	15	10.0
Malnutrition	45	30.0

Table No. 3: Seizure Characteristics and Control

Seizure Characteristics	Frequency (n)	Percentage (%)
Seizure Frequency		
Frequent (≥2 times per week)	45	30.0
Infrequent (<2 times per week)	105	70.0
Seizure Control		
Achieved Seizure Control	72	48.0
Uncontrolled Seizures	78	52.0

Table No. 4: Association Between Risk Factors and Seizure Frequency

Risk Factor	Seizure Frequency (≥2/week)	Seizure Frequency (<2/week)	p-value
Infections	30 (50%)	30 (50%)	0.03
Perinatal Complications	33 (55%)	57 (45%)	0.04
Malnutrition	18 (40%)	27 (60%)	0.02

DISCUSSION

The purpose of this study was to establish the prevalence and determinants of paediatric epilepsy in a low income country for infections, perinatal factors and malnutrition. The study explodes that infections such as cerebral malaria, meningitis, and neurocysticercosis, perinatal factors including birth asphyxia, prematurity, birth trauma, and malnutrition are important anti epileptic factors or causes of epilepsy among children in low-income areas. The findings corroborate the prior studies, pointing at the long-standing problem in the LICs where the availability of – primary healthcare, nutritional, and preventive services – remains low. Risk factors which include infections among children with pediatric epilepsy in LICs have been well illustrated in many previous studies. For example, a study performed by Abdullahi et al. (2017) in sub-Saharan Africa has identified cerebral malaria as one of the top demographic epilepsy risk factors among children, and that developmental epilepsy in children relates to severe malaria infections in most cases. The authors Gwer et al. also found raised risk of epilepsy among Kenyan children with past malaria involving the brain in their study done in 2017[8]. These are in line with our study whereby cerebral malaria was identified in 25% of the cases with an association to early-onset epilepsy at p = 0.03. The effects of cerebral malaria on the developing brain are known, as well as inflammation and neuronal injury that play significant roles in achieving seizures[9]. There are several antecedents of perinatal features and pediatric epilepsy, with birth asphyxia and prematurity being well described. Another study by Zubairi et al (2021) in Pakistan asserted that birth asphyxia is a leading cause of febrile seizures mind you, childhood epilepsy[10]. We found perinatal complications in 60% of cases with birth asphyxia piloting 15% of risk factor profile as presented in the next topic. The characteristics of the patients were as follows: Children born prematurely were more likely to have refractory seizures, p = 0.05 The above finding is consistent with the other research done that showed that preterm infants are more prone to neurological complications such as epilepsy. Other risk factors that have been also found to be related to epilepsy in the LICs include; malnutrition. Ransom et al., in his study, observed that children suffering from malnutrition, protein energy malnutrition alongside micro nutrient deficiencies such as vitamin B6 lead to development of epilepsy in children. Although 59 (30%) percent of the children with epilepsy had history of malnutrition, there was significant correlation between malnutrition and frequency of seizures(p = 0.04). Deficient diet negatively affects, brain formation and functionality hence such children may be prone to nervous disorders including epilepsy. Another study has shown that conditions such as Zinc and vitamin B6 deficiencies that are rampant among malnourished children make neurons more prone to seizures[11]. Moreover to the direct impacts of infections, perinatal factors and malnutrition, socio-economic conditions in LICs play a part to the burden of paediatric epilepsy. The level of understanding as well as access to healthcare centers is low in developing nations this makes the effects of epilepsy even worse. According to Patel et al., 2020, delay in accessing healthcare in low income countries mean poor clinical outcomes and high disability rates among children having epilepsy[12]. The results of this study correlate with current scholarship, pointing to the need for more specific public health strategies in LICs. Providing better antenatal and postnatal care, intervention for malnutrition, increasing early diagnosis for infections and epilepsy and management are crucial in order to reduce burden of the pediatric epilepsy in such context. More study is required to investigate other socio-economic and environmental characteristics that increases risk of childhood epilepsy[13-15].

CONCLUSION

Infections and perinatal complications and malnutrition as modifiable risk factors to paediatric epilepsy in low-income countries. The findings act as a backup of Faulkner, affirming with him that early diagnosis and effective intervention must rest alongside improvement in the healthcare systems in countries within the developing world. The intervention on these risk factors may help to alleviation on the burden of epilepsy on these settings, and enhanced prognosis of the affected children.

Limitations: A potential shortcoming of this work is cross-sectional study design thus the inability to make causal inferences regarding the given risk factors

relating to epilepsy. Furthermore, the study sample was confined to a single regional hospital patients, and therefore may not have reached a level of generalizability in other regions. There may also be biases that arise from using medical record data since data arise from patient encounter.

Future Findings: Future research work should use prospective data setups in order to determine how exactly all the risk factors mentioned above contribute to the progression of epilepsy in children. Further, detailed studies about the efficacy of individual approaches applied to the issues of malnutrition and infections, as well as the issues of prenatal and postnatal care should be conducted to decrease epilepsy rates in LICs.

Abbreviations based on your study:

- LIC: Low-Income Country
- EEG: Electroencephalogram
- SD: Standard Deviation
- SPSS: Statistical Package for the Social Sciences
- p-value: Probability Value
- n: Number of participants
- CI: Confidence Interval
- BMI: Body Mass Index
- IQR: Interquartile Range
- B6: Vitamin B6
- WHO: World Health Organization
- CDC: Centers for Disease Control and Prevention
- BMI: Body Mass Index
- HR: Hazard Ratio
- OR: Odds Ratio

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Author's Contribution:

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