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Original Article

(Incidence of convulsion in paediatrics in 2024 in the intensive care unit at Tobruk medical centre)

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Abstract:

Background: Seizures are among the most common neurological manifestations in infancy and childhood. They are not a single disease, but rather a symptom of many underlying disorders with different causes. Neonatal seizures, febrile seizures, and epilepsy overlap to some extent, as children who experience neonatal or febrile seizures have a higher risk of developing epilepsy later. However, these conditions differ in their risk factors and epidemiological patterns. Seizures may also be triggered by other acute conditions, such as head trauma, although their exact frequency in children is difficult to determine.

Aim: This study aimed to determine the frequency of convulsions among children in Tobruk, Libya, to identify the most common causes, and to analyse demographic factors such as age and gender. It also sought to improve clinical awareness and support future preventive and treatment strategies in the region. **Methods:** A total of 136 cases of convulsions in children aged from 1 day to 13 years were collected between February and December 2024. The study was conducted in the pediatric intensive care unit (ICU) at Tobruk Medical Centre, Tobruk City, Libya. Data collection included age, gender, family history, body temperature, type of convulsion, number of attacks, diagnosis, treatment, and admission status. Ethical approval was obtained from Tobruk Medical Centre and the Faculty of Medicine at Tobruk University, and informed consent was obtained from the parents of all participants. **Results:** The most common diagnosis was febrile seizures, accounting for 38 cases (27.9%), followed by acute central nervous system (CNS) infections in 25 patients (18.4%) and epilepsy (chronic or recurrent) in 20 patients (14.7%). Other notable causes included genetic or congenital syndromes (9.6%), neonatal metabolic or genetic seizures (8.1%), and cases of uncertain cause (8.1%). Less common etiologies included acute provoked seizures related to metabolic or electrolyte disturbances or trauma, neonatal structural or ischemic causes, and toxic ingestion, which was the least frequent cause at 1.5%. Febrile seizures were slightly more common in females, with 22 cases compared with 16 cases in males.

Keywords: convulsion: paediatrics: intensive care unit: centre

Introduction

A seizure is not a specific disease, but rather a heterogeneous clinical condition that results from a wide range of pathological insults affecting the cerebral cortex, such as tumours or genetic channelopathies (1). Seizures and epilepsy affect infants and children more than any other age group [5]. Studies have shown that epilepsy is one of the most common conditions encountered in pediatric neurology clinics in many parts of the developing world [5]. Children diagnosed with epilepsy face considerable challenges. The seizures themselves, especially when poorly controlled, may be disabling and can interfere with learning and development. In addition, secondary factors such as stigma and limited knowledge about the condition may negatively affect the child's social and psychological well-being. Febrile seizures or febrile convulsions (FCs) are seizures that occur in young children [1]. They are among the most common seizure disorders experienced during infancy and early childhood, particularly between the ages of 6 months and 6 years, with an incidence of less than 4.0% [1]. FCs refer to seizures that occur in association with fever in the absence of meningitis, encephalitis, serum electrolyte imbalance, or other acute neurological illnesses. Several studies have investigated the molecular genetics and pathogenesis of febrile seizures (1).

The American Academy of Pediatrics [10] defines a febrile seizure as a seizure accompanied by fever (temperature ≥38°C), without evidence of central nervous system infection, occurring in infants and children aged 6 to 60 months. Febrile seizures are further classified as simple or complex, and they are the most common type of seizures observed in pediatric practice. Their classification is important because it helps guide the clinical evaluation and long-term management of children who experience fever-associated seizures [10].

Previously published studies have shown that febrile seizures are not associated with an increased risk of mortality in children [18]. The recurrence rate is about 10.0% in patients with no risk factors, 25% to 50% in those with a few risk factors, and 50% to 100% in those with multiple risk factors [18]. The risk of developing epilepsy is estimated to be around 1.5% in children with simple febrile seizures [20], whereas in children with complex febrile seizures, the risk increases to between 4.0% and 15.0% [20].

Seizures during the neonatal period are also a major clinical concern, not only because they may indicate an underlying neurological or metabolic disorder, but also

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because they are strongly associated with permanent disabilities among survivors. The neonatal brain is particularly vulnerable, and seizures during this period may lead to long-term neurological damage (2).

Materials and Methods

This comparative study was conducted in the Intensive Care Unit (ICU) of the Pediatric Department at Tobruk Medical Centre, Libya, from 1 January 2024 to 31 December 2024. The study population consisted of children admitted to the ICU during the study period. All children aged from 1 day to 13 years who developed clinically identifiable seizures were enrolled in the study. Data were collected using a structured form and included age, gender, family history, body temperature, type of convulsion, number of attacks, diagnosis, treatment, and admission status. A detailed medical history was obtained for all included children. Seizure type was diagnosed on the basis of clinical observations made by the authors and resident doctors. The etiology of seizures was determined using laboratory investigations and, where indicated, brain imaging studies, including ultrasonography and computed tomography (CT) scan.

The diagnostic criteria for biochemical abnormalities were as follows: hypocalcemia was defined as serum calcium <7.0 mg/dL, hypomagnesemia as serum magnesium <1.5 mg/dL, and hyponatremia as serum sodium <135 mEq/L. Hypoglycemia was diagnosed when blood glucose levels were less than 45 mg/dL in term infants, less than 40 mg/dL in preterm infants, and less than 60 mg/dL in children. Cerebrospinal fluid (CSF) examination was considered abnormal in the presence of elevated CSF leukocytes, low CSF glucose, elevated CSF protein, and/or a positive culture [2].

Non-seizure movements were carefully differentiated from true seizures and excluded from the study. The exclusion criteria included children with jitteriness or sleep-related muscular movements.

Ethical Approval

This study was conducted after obtaining ethical approval from the Institutional Review Board of Tobruk Medical Center (Ethical Approval Number: NBC:009.H.25.8). Additional approval was obtained from the Faculty of Medicine, Tobruk University. Written informed consent was obtained from the parents of all participants before inclusion in the study.

To protect patient privacy, all data were fully anonymised and de-identified before analysis. The confidentiality of patient information was strictly maintained, and the data were used exclusively for research purposes. The study adhered to ethical principles for research involving human participants, including respect for confidentiality and the right of participants to withdraw at any time.

Statistical Analysis

All statistical analyses were performed using R version 4.4.2. Descriptive statistics were used to summarise the demographic, clinical, and diagnostic characteristics of the study population. Continuous variables, such as age, were expressed as mean ± standard deviation (SD) and median with interquartile range (IQR). Categorical variables were presented as frequencies and percentages. Associations between categorical variables were assessed using the Chi-square test (χ^2). Comparisons of continuous variables between groups were performed using the independent samples t-test. A p-value of less than 0.05 was considered statistically
significant. Results:

Demographic and Clinical Characteristics

A total of 136 patients were included in the study. The mean age of the participants was
3.59 ± 3.63 years, while the median age was 2.00 years (IQR: 5.27), suggesting a right- skewed age distribution with a higher concentration of cases among younger children. The gender distribution was relatively balanced, with 72 males (52.9%) and 64 females (47.1%).More than half of the patients (58.1%) had fever at the time of admission, whereas 41.9% did not. Status epilepticus was identified in 17 patients (12.5%). In addition, 48 patients (35.3%) had a positive family history of seizures or epilepsy.

Table 1: Demographic and Clinical Characteristics of the Study Population (N=136

Characteristic	**Value**
Age (years), mean ± SD	3.59 ± 3.63
Age(years),median(IQR)	2.00 (5.27)
Gender, n (%)	
Male	72 (52.9%)
Female	64 (47.1%)
FeveronAdmission,n(%)	
Yes	79 (58.1%)
No	57 (41.9%
Status Epilepticus, n(%)	
Yes	17 (12.5%
No	119 (87.5%)
Family History of Seizures/Epilepsy, n (%	
Positive	48 (35.3%)
Negative	88 (64.7%)

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Age Distribution

When the patients were categorised by age group, the largest proportion (30.9%) was infants aged 1–11 months. This was followed by children aged 5–10 years (25.0%) and those aged 2–5 years (18.4%). Smaller proportions were observed in the 1–2 years age group (16.9%) and the 10–13 years age group (8.8%). Overall, this distribution suggests that convulsive presentations were more common in early childhood, particularly during infancy.

Table 2: Distribution of Patients by Age Group

Age Group	n (%)
1-11 months	42 (30.9%)
1-2 years	23 (16.9%)
2-5 years	25 (18.4%)
5-10 years	34 (25.0%)
10-13 years	12 (8.8%)

Etiology of Convulsions

The most common cause of convulsions in the study population was febrile seizure, which accounted for 38 cases (27.9%). This was followed by acute central nervous system (CNS) infections in 25 patients (18.4%) and epilepsy (chronic or recurrent) in 20 patients (14.7%). Other important causes included genetic or congenital syndromes in 13 cases (9.6%), neonatal metabolic or genetic seizures in 11 cases (8.1%), and convulsions of uncertain or unclear cause in 11 cases (8.1%).

Less common etiologies included acute provoked seizures related to metabolic or electrolyte disturbances in 7 patients (5.1%) and structural or trauma-related causes in 5 patients (3.7%). Neonatal structural or ischemic seizures accounted for 4 cases (2.9%), while toxic ingestion was the least frequent cause, reported in only 2 cases (1.5%).

Table 3: Etiology of Convulsions

Diagnosis	n (%)
Febrile Seizure	38 (27.9%)
Acute CNS Infection	25 (18.4%)
Epilepsy (Chronic/Recurrent)	20 (14.7%)
Genetic / Congenital Syndromes	13 (9.6%)
Neonatal Metabolic/Genetic Seizures	11 (8.1%)
Uncertain / Unclear Cause	11 (8.1%)
Acute Provoked (Metabolic/Electrolyte)	7 (5.1%)
Acute Provoked (Structural/Trauma)	5 (3.7%)
Neonatal Structural/Ischemic Seizures	4 (2.9%)
Toxic/Ingestion	2 (1.5%)
Clinical Presentation and Investigations The majority of patients (86.8%) presented	with generalized tonic-clonic seizures.

Focal seizures were observed in 6.6% of cases, while 5.1% of patients experienced focal seizures with secondary generalization. Only 2 patients (1.5%) had generalized seizures recorded as a second attack.

Lumbar puncture was not performed in 50.7% of patients, based on clinical judgment or the patient's condition. In 14.7% of cases, the procedure was refused by the family. Among the patients who underwent lumbar puncture, 17 (12.5%) had positive findings suggestive of infection, whereas 30 (22.1%) had normal cerebrospinal fluid findings.

Assessment of developmental status showed that most children (72.1%) had normal development. Developmental delay was identified in 18 patients (13.2%), while the developmental status of 19 patients (14.0%) was still under evaluation at the time of data collection. Developmental status was unknown in one patient (0.7%).

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Table 4: Clinical Presentation and Investigations

Type of Convulsion	n (%)
Generalized Tonic-Clonic	118 (86.8%)
Focal	9 (6.6%)
Focal, sometimes generalizing	7 (5.1%)
Generalized, 2nd attack	2 (1.5%)
Lumbar Puncture Result	
Not Done	69 (50.7%)
Free, No Meningitis	30 (22.1%)
Family Refused	20 (14.7%)
Done, Positive	17 (12.5%)
Developmental Status	
Normal	98 (72.1%)
Delay	18 (13.2%)
Still	19 (14.0%)
Unknown	1 (0.7%)

16 cases

Cross-tabulation and Association Analyses: **Gender and Diagnosis**

No statistically significant association was found between gender and diagnosis ($\chi^2 = 0.471$, $p = 0.493$). However, the descriptive cross-tabulation presented in Table 5 showed some variation in the distribution of diagnoses by gender. Febrile seizures were slightly more common among females, with 22 cases compared with among males. In contrast, epilepsy (chronic or recurrent) and genetic or congenital syndromes were more frequently observed among males.

These findings suggest that although some differences were noted in the pattern of diagnoses between males and females, gender was not significantly associated with the type of diagnosis in this study population.

Cross-Tabulation and assoclation analyses

Table 5: Diagnosis by Gender

Diagnosis	Female	Male	Total
Febrile Seizure	22	16	38
Acute CNS Infection	12	13	25
Epilepsy (chronic/recurrent)	7	13	20
Genetic / Congenital Syndromes	3	10	13
Neonatal Metabolic/Genetic Seizures	6	5	11
Uncertain / Unclear Cause	6	5	11
Acute Provoked — Metabolic/Electrolyte	3	4	7
Acute Provoked — Structural/Trauma	2	3	5
Neonatal Structural/Ischemic Seizures	2	2	4
Toxic/Ingestion	1	1	2

Age and Diagnosis

The distribution of diagnoses differed across age groups (Table 6). Among infants aged 1–11 months, the most common diagnoses were febrile seizures, acute CNS infections, and epilepsy. In the 1–2 years age group, acute CNS infections were the leading diagnosis, followed by febrile seizures and genetic or congenital syndromes. Among children aged 2–5 years and 5–10 years, febrile seizures remained the most frequent diagnosis, while epilepsy and genetic or congenital

syndromes were also common. In the oldest age group (10–13 years), acute CNS infections were the most common diagnosis, whereas febrile seizures were less frequent. Overall, febrile seizures appeared among the leading diagnoses in most age groups, except in children aged 10– 13 years, where acute CNS infections were more prominent.

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Table 6: Top Diagnoses by Age Group

Age Group 1-1	**Primary Diagnosis**		**Secondary Diagnosis**	**n**	**Tertiary Diagnosis**	**n**
months	Febrile Seizure	Acute	CNS Infection	9	Epilepsy	8
1-2years Infection	Acute	5	CNS	4	Genetic/Congenital	**4**
2-5 years	Febrile Seizure	**10**	Epilepsy	**5**	Epilepsy	**4**
5-10 years	Febrile Seizure		Epilepsy	**6**	Genetic/Congenital Syndromes	**6**
10-13 years	Acute Infection	CNS	Provoked (Metabolic)	**2**	Febrile Seizure	**2**

Fever and Diagnostic Categories

Fever was most commonly observed in patients with neonatal metabolic or genetic seizures (72.7%), acute CNS infections (68.0%), and febrile seizures (65.8%). By contrast, epilepsy was more frequently associated with afebrile presentations, with 70.0% of epilepsy cases occurring in children without fever (Table 7). Genetic or congenital syndromes showed a more balanced distribution between febrile and afebrile cases.

Despite these descriptive differences, statistical analysis did not demonstrate a significant association between fever and status epilepticus ($\chi^2 = 1.558$, $p = 0.212$), or between fever and family history of seizures or epilepsy ($\chi^2 = 0.751$, $p = 0.386$).

Table 7: Fever Presence by Top 5 Diagnoses

Diagnosis	**Fever: Yes**		**Fever: No**	
	n	**%**	**n**	**%**
Acute CNS Infection	17	68.0%	8	32.0%
Epilepsy (chronic/recurrent)	6	30.0%	14	70.0%
Febrile Seizure	25	65.8%	13	34.2%
Genetic / Congenital Syndromes	7	53.8%	6	46.2%
Neonatal Metabolic/Genetic Seizures	8	72.7%	3	27.3%

Family History and Diagnosis

A positive family history of seizures or epilepsy was observed somewhat more frequently among patients with febrile seizures (31.6%), epilepsy (30.0%), and genetic or congenital syndromes (30.8%) than among those with neonatal metabolic or genetic seizures (18.2%) (Table 8). Acute CNS infections also showed a comparable proportion of positive family history (36.0%).

Although these descriptive patterns suggest some variation across diagnostic categories, the differences were not statistically significant.

Table 8: Family History of Epilepsy by Top 5 Diagnoses

Family History: Negative	**Family**		**History: Positive**	
	n	**%**	**n**	**%**
Acute CNS Infection	16	64.0%	9	36.0%
Epilepsy (chronic/recurrent)	14	70.0%	6	30.0%
Febrile Seizure	26	68.4%	12	31.6%
Genetic / Congenital Syndromes	9	69.2%	4	30.8%
Neonatal Metabolic/Genetic Seizures	9	81.8%	2	18.2%

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status Epilepticus and Age

A clear age-related trend was observed in the occurrence of status epilepticus, with the proportion increasing in the older age groups. The highest proportion was recorded among children aged 10–13 years, where 33.3% presented with status epilepticus. In contrast, status epilepticus was uncommon in infants aged 1–11 months (2.4%) and was not observed in children aged 1–2 years. Intermediate proportions were found in the 2– 5 years group (16.0%) and the 5–10 years group (23.5%). Although formal statistical testing was not performed for this comparison, the pattern suggests that status epilepticus may become more frequent with increasing age in this study population.

Table 9: Status Epilepticus by Age Group

Age Group	Status Epilepticus: No		Status Epilepticus: Yes	
	n	%	n	%
1-11 months	41	97.6%	1	2.4%
1-2 years	23	100.0%	0	0.0%
2-5 years	21	84.0%	4	16.0%
5-10 years	26	76.5%	8	23.5%
10-13 years	8	66.7%	4	33.3%

Fever and Family History

Among patients with a positive family history of seizures or epilepsy, 52.1% presented with fever, compared with 61.4% of those with a negative family history. This difference was not statistically significant (p = 0.386), indicating that family history was not meaningfully associated with the presence of fever in this study population.

Table 10: Fever Presence by Family History

Family History	Fever: No		Fever: Yes	
	n	%	n	%
Negative	34	38.6%	54	61.4%
Positive	23	47.9%	25	52.1%

Recurrent Admissions

Only 5 patients (3.7%) had recurrent admissions. Among these cases, acute CNS infection was the most common diagnosis, accounting for 2 patients. The remaining recurrent admissions were associated with acute provoked seizures due to metabolic, electrolyte, or endocrine causes, febrile seizure, and an uncertain or unclear etiology, with 1 case each (Table 11). Because of the very small number of recurrent cases, no statistical comparison was performed for this subgroup.

Table 11: Characteristics of Patients with Multiple Admissions (n=5)

Diagnosis in Recurrent Cases	n
Acute CNS Infection	2
Acute Provoked — Metabolic/Electrolyte/Endocrine	1
Febrile Seizure	1
Uncertain / Unclear Cause	1

Summary of Statistical Tests

As presented in Table 12, none of the examined associations between gender, fever, status epilepticus, and family history were statistically significant. For example, there was no significant difference in age between males and females (t = 0.698, df = 132.6, p = 0.486), and the overall gender distribution was also not statistically significant (χ^2 = 0.471, df = 1, p = 0.493). Similarly, no significant associations were found between fever and status epilepticus (χ^2 = 1.558, df = 1, p = 0.212) or between fever and family history (χ^2 = 0.751, df = 1, p = 0.386). Overall, these findings indicate that the tested demographic and clinical variables were not significantly associated within this study population.

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Table 12: Summary of Statistical Analyses

Test	Statistical Values	p-value
Gender Distribution	$\chi^2 = 0.471$, df = 1	0.493
Age Difference by Gender	t = 0.698, df = 132.6	0.486
Fever vs. Status Epilepticus	$\chi^2 = 1.558$, df = 1	0.212
Fever vs. Family History	$\chi^2 = 0.751$, df = 1	0.386

Frequency of Convulsions Among PICU Admissions:
The frequency of convulsion cases among total PICU admissions during the study period was calculated as follows:
Frequency (%) = (Number of convulsion cases / Total PICU admissions) × 100. Frequency (%) = (136 / 760) × 100 = 17.9%.
Thus, convulsion cases accounted for 17.9% of all PICU admissions during the study period

Age Group Distribution of Pediatric Patients with Convulsions

Figure 1shows that the largest proportion of pediatric patients with convulsions was in the 1–11 months age group, with 42 cases. This was followed by children aged 5–10 years (34 cases), 2–5 years (25 cases), and 1–2 years (23 cases). The 10–13-year age group had the lowest number of cases, with 12 patients.

Overall, the figure indicates that convulsions were most common in infants and younger children, with frequency generally decreasing in older age groups, although a secondary rise was observed among children aged 5–10 years.

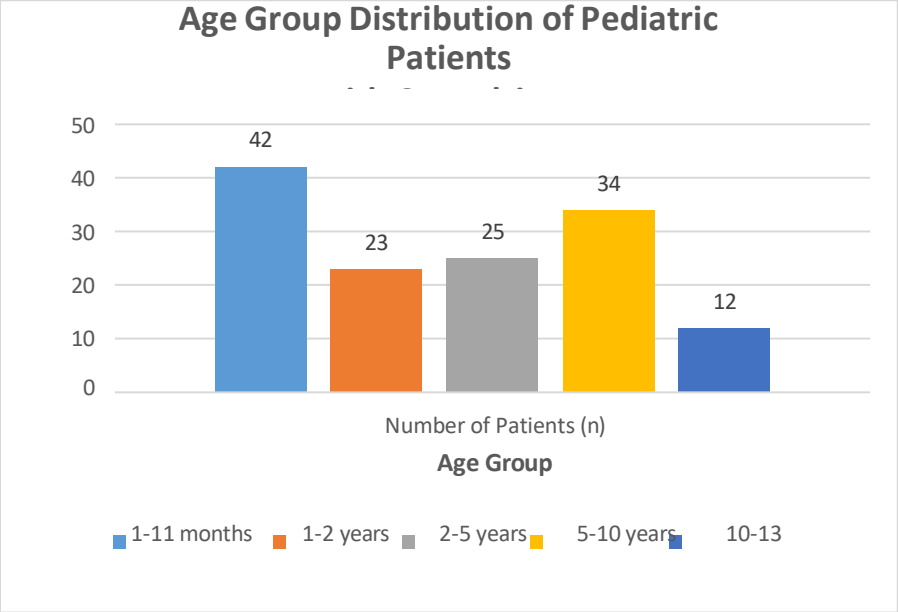

Figure. 1: Age Group Distribution of Pediatric Patients with Convulsions

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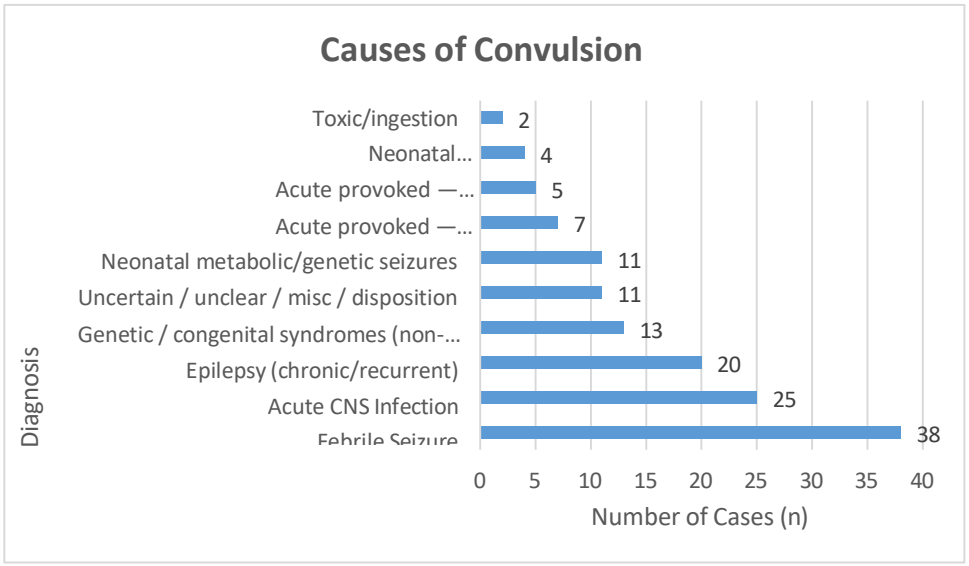

Figure 2: Causes of Convulsion

Diagnosis by Gender

Figure 3 shows that the distribution of diagnoses was broadly similar between males and females, although some differences were observed in specific categories. Febrile seizures were slightly more common in females (22 cases) than in males (16 cases). In contrast, epilepsy and genetic/congenital syndromes were more frequent among males, with particularly noticeable differences. For other diagnoses, such as acute CNS infection, neonatal metabolic/genetic seizures, and uncertain causes, the differences between males and females were relatively small. The least common causes, including neonatal structural/ischaemic seizures and toxic ingestion, were rare in both sexes.

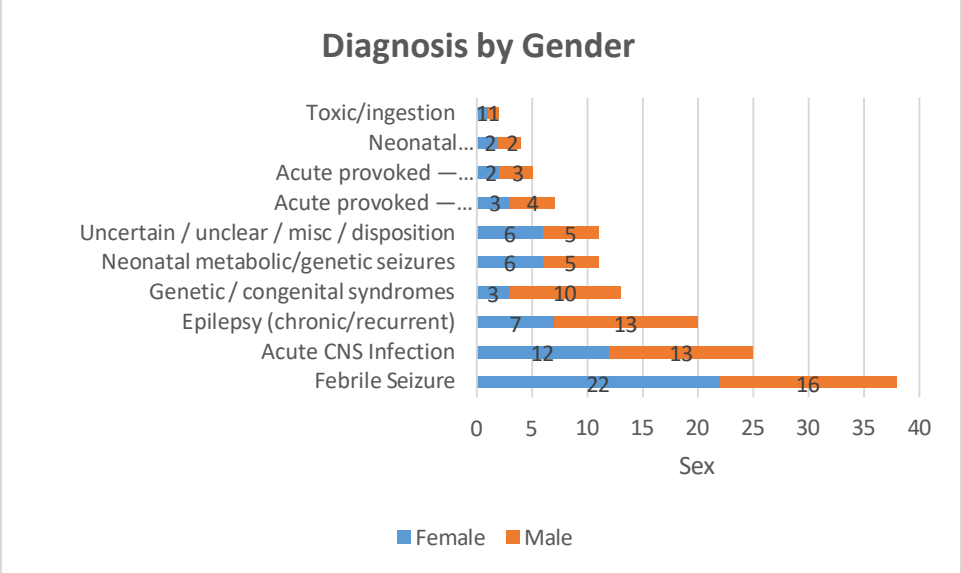

Figure 3: Diagnosis by Gender

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Discussion

This study provides important ICU-based evidence on the burden, clinical profile, and etiological spectrum of pediatric convulsions in Tobruk, Libya. Convulsion cases accounted for 17.9% of all PICU admissions during the study period, indicating that seizures represent a substantial component of pediatric critical care in this setting. This proportion is clinically meaningful because it shows that convulsions in Tobruk are not confined to isolated, low-risk events, but constitute a recurrent and resource-intensive reason for admission. More importantly, the findings reveal that the burden is shaped by a mixture of relatively common childhood seizure disorders and more serious infectious, structural, and chronic neurological conditions.

The clearest finding is that febrile seizures were the most frequent diagnosis, accounting for 27.9% of cases. This is consistent with the broader pediatric literature, which identifies febrile seizures as the most common seizure type in early childhood, and it also agrees with previous Libyan studies reporting the predominance of febrile convulsions among children [1,3,15,19]. However, the present findings also complicate that familiar pattern. Febrile seizures were the leading cause, but they did not overwhelmingly dominate the cohort. Acute CNS infections ranked second (18.4%), followed by epilepsy (14.7%), with additional contributions from genetic or congenital syndromes and neonatal seizure disorders. This distribution suggests that the clinical reality in an intensive care setting differs from that seen in general pediatric or outpatient populations, where febrile seizures often account for a larger and comparatively more benign share of presentations. In other words, while the study confirms the continuing importance of febrile seizures, it also shows that

Convulsions requiring ICU care in this context are strongly shaped by more severe and diagnostically complex etiologies.

The prominence of acute CNS infections is particularly important. In many low- and middle-resource settings, seizure presentations are closely linked to infectious disease burden, delayed presentation, and limited access to early neurological assessment. The fact that CNS infections represented nearly one-fifth of all cases suggests that infectious neurological disease remains a major cause of severe pediatric convulsions in Tobruk. This distinguishes the current cohort from samples in which febrile seizures and idiopathic epilepsies are more clearly dominant. It also has practical implications, because infection-related seizures often demand urgent diagnostic clarification, aggressive treatment, and closer neurological follow-up than simple febrile seizures. Thus, one of the study's key contributions is to show that the local burden of pediatric convulsions extends well beyond the expected The age pattern reinforces this interpretation. The largest proportion of cases occurred among infants aged 1–11 months, and the overall age distribution was right-skewed, with a greater concentration of cases in younger children. This broadly supports existing knowledge that early childhood is a period of heightened seizure vulnerability because of rapid brain maturation, lower seizure thresholds, exposure to fever and infection, and the emergence of some metabolic and genetic disorders. At the same time, the present age pattern differs somewhat from studies that place the peak of febrile convulsions around 1–2 years of age and report lower frequencies below 6 months or after 3 years [12,13,14]. That difference is noteworthy rather than problematic. It likely reflects the ICU-based nature of the sample, which captures more severe neonatal, infectious, and metabolic presentations and therefore shifts the burden toward younger ages. This is an important point of contrast: the present study is not simply describing seizure occurrence in the general pediatric population, but rather the profile of children whose convulsions were severe enough to require intensive care.

The clinical presentation was dominated by generalized tonic-clonic seizures, which accounted for 86.8% of cases. This is consistent with previous studies showing that generalized seizures represent the most visible and most frequently recognized seizure phenotype in pediatric clinical practice [5]. Yet the significance of this finding lies not only in its consistency with the literature, but also in what it implies about triage and detection. In emergency and ICU settings, generalised convulsive events are more likely to prompt urgent admission because they are dramatic, prolonged, and difficult to miss, whereas subtle, focal, or non-motor seizures may be under-recognised or managed differently. Accordingly, the predominance of generalised tonic-clonic seizures may reflect both genuine clinical burden and the realities of emergency identification and referral. Status epilepticus was documented in 12.5% of the cohort, emphasising the severity of

a notable minority of cases. The descriptive trend toward a higher proportion of status epilepticus in older age groups is particularly interesting. It was rare in infants and absent in the 1–2 years group, but increased progressively in older children, reaching its highest proportion in the 10–13 years category. Although this pattern was not formally tested statistically and therefore should be interpreted cautiously, it may indicate that older children admitted to the PICU were more likely to have prolonged or refractory seizures, possibly because of more complex underlying etiologies such as epilepsy, structural causes, or severe infection. This contrasts with the age pattern of overall seizure frequency, which was concentrated in infancy and early childhood. Taken together, these findings suggest that younger

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childrencontributed more heavily to the volume of admissions, whereas older children may have contributed disproportionately to the more severe end of the convulsive spectrum.

The gender findings were more modest. Although males constituted a slight majority of the cohort, the overall sex distribution was relatively balanced, and the association between gender and diagnosis was not statistically significant. Descriptively, febrile seizures were somewhat more common in females, whereas epilepsy and genetic or congenital syndromes were more frequent in males. This partly contrasts with some earlier reports, including local work, in which febrile seizures were more common among boys [1,19]. However, the absence of statistical significance is important here. It suggests that while some sex-based variation may be present at the descriptive level, gender did not function as a strong organizing factor in the etiological pattern of convulsions in this sample. This is a useful corrective to overly deterministic interpretations of sex differences in pediatric seizures. In this cohort, diagnosis appears to have been driven more by underlying pathology and clinical severity than by gender alone.

The same cautious interpretation applies to family history. A positive family history of seizures or epilepsy was present in 35.3% of the total sample and appeared somewhat more frequently among children with febrile seizures, epilepsy, and genetic or congenital syndromes. Although these differences were not statistically significant, the proportion itself is clinically notable and appears higher than that reported in some earlier Libyan work on febrile convulsions [1]. This may point to a meaningful hereditary component in at least part of the cohort, or alternatively to the enrichment of more neurologically vulnerable children in an ICU setting. Either way, the result suggests that family history remains clinically relevant even when it does not emerge as a strong independent predictor in subgroup analysis. In practice, it should still inform assessment and follow-up, particularly for children presenting with recurrent seizures, epilepsy, or suspected genetic conditions.

One of the most revealing findings of the study concerns diagnostic practice. Lumbar puncture was not performed in more than half of the patients, and in a further 14.7% of cases, it was refused by the family. This is especially striking given that acute CNS infection was the second most common diagnosis. The contrast between the high burden of suspected infectious etiologies and the limited completion of lumbar puncture points to a clinically important gap between diagnostic need and diagnostic implementation. This gap may reflect several overlapping factors, including the child's clinical instability, physician caution, parental fear, communication barriers, or distrust of invasive procedures. Whatever the immediate reason, the implication is clear: in a setting where CNS infections remain common, incomplete investigation may delay definitive diagnosis and appropriate treatment. This is one of the study's most practically important contributions, because it identifies a specific and potentially modifiable barrier to improving seizure care.

The developmental findings further underline the heterogeneity of the cohort. Most children had normal developmental status, but a meaningful minority had established developmental delay or were still under developmental evaluation. This suggests that convulsions in this population were not solely acute, isolated episodes; in a subset of children, they occurred within a broader context of neurodevelopmental vulnerability. That observation matters because it helps explain why simple demographic variables did not show strong statistical associations with diagnosis. The cohort was etiologically diverse and clinically layered, including febrile, infectious, epileptic, metabolic, neonatal, and developmental pathways into seizure presentation. In such a heterogeneous clinical population, it is unsurprising that no single factor, such as sex, fever, or family history, fully explains diagnostic variation.

Indeed, one of the strengths of the study is that it does not overstate statistically non- significant findings. None of the tested associations between gender, fever, status epilepticus, and family history reached statistical significance. Rather than weakening the study, this result strengthens its interpretive value by discouraging overly simple conclusions. It suggests that pediatric convulsions in this ICU population cannot be reduced to a few demographic risk markers. Instead, they reflect a more complex interaction between age-related vulnerability, infectious burden, chronic neurological disease, inherited predisposition, and the practical realities of critical care diagnosis. This is precisely why local ICU-based evidence matters: it captures a level of clinical complexity that broader community-based seizure statistics often obscure.

Contributions of the Study

This study makes several contributions to the literature. First, it provides updated hospital-based evidence on pediatric convulsions from eastern Libya, a setting for which contemporary ICU-focused data remain limited. Second, it demonstrates that although febrile seizures remain the single most common cause, the overall burden of convulsions requiring intensive care is more etiologically diverse and clinically serious than general pediatric patterns may suggest. Third, it identifies acute CNS infection as a major contributor to severe seizure presentation in this setting, thereby drawing attention to the continuing importance of infectious neurological disease in pediatric practice. Fourth, it highlights lumbar puncture non-performance and family refusal as a concrete clinical bottleneck, linking epidemiological description with a directly actionable systems issue.

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Finally, by showing that descriptive patterns do not always translate into statistically significant associations, the study contributes a more nuanced understanding of seizure epidemiology in critically ill children and argues for caution in relying on demographic shortcuts in clinical interpretation.

Limitations

Several limitations should be acknowledged. The study was conducted in a single tertiary centre and included only children admitted to the PICU, which means the sample was likely enriched for more severe or complicated cases. The findings, therefore, should not be generalised to all pediatric seizure presentations in Libya. The one-year study period may also have limited the ability to capture broader temporal fluctuations, particularly in infection-related etiologies. In addition, some subgroup counts were small, which reduced statistical power and may have contributed to the absence of significant associations. Finally, because the study focused on admission characteristics, it could not address longer-term neurological outcomes, recurrence patterns beyond the study period, or post-discharge developmental trajectories.

Conclusion

In conclusion, this study shows that pediatric convulsions in the Tobruk PICU represent a substantial and clinically heterogeneous burden. Febrile seizures were the most common diagnosis, but acute CNS infections, epilepsy, and other serious neurological conditions also accounted for a large proportion of admissions. The burden was concentrated in younger children, particularly infants, while more severe manifestations such as status epilepticus appeared to become more prominent with increasing age. The findings also draw attention to an important gap in diagnostic practice, particularly around lumbar puncture in suspected infectious cases. Overall, the study adds valuable local evidence and suggests that improving outcomes will require not only better acute seizure management, but also stronger parental communication, more timely investigation of infectious causes, and improved neurological follow-up for high-risk children.

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