



(RESEARCH ARTICLE)



PRESCRIBING PATTERN IN CHILDREN WITH SEIZURES: A CROSS-SECTIONAL STUDY IN A PEDIATRIC INTENSIVE CARE UNIT OF A TERTIARY CARE HOSPITAL, MANDYA, KARNATAKA, INDIA

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ABSTRACT

Background: Seizure is defined as an abrupt and transient disturbance of neurological function brought on by an excessive and coordinated firing of neurons in the brain. The ILAE standards divide seizures into three types: generalized, focal, and undetermined onset. Generalized seizures are caused by neural networks in both hemispheres and can be characterized as absence, generalized tonic-clonic, myoclonic, or atonic. Seizures with an unknown onset may begin in a specific area of one cerebral hemisphere. Facilitating rational drug usage in communities is the main goal of drug use research. For each patient, rational drug usage means prescribing a well-researched medication at an appropriate dosage for the appropriate indication, with the relevant information, and a reasonable cost.

Objective: The aim of the study was to analyze and evaluate prescribing pattern in Intensive Care Unit of Pediatrics.

Methods and methodology: A Cross-sectional study was conducted: In-patients who are getting treated in PICU who met the inclusion and exclusion criteria has been included in the study.

Results: This study analyzed 150 prescriptions, of which 65.8% were male and 46.5% were aged 1 month–<2 years. Simple febrile seizures were most common (65.78%), followed by breakthrough seizures (19.73%). A family history of consanguinity was present in 15.78%. Among 235 antiepileptic drugs prescribed, clobazam (42.1%) and levetiracetam (39.47%) were most frequent, with tablets (48.24%) being the predominant formulation. Monotherapy was used in 63.15% of cases. Previous hospitalization was reported in 38.2%, while 58.55% required 4–6 days of hospital stay. Co-morbidities were observed in 35.52%, mainly anemia (33.33%) and dehydration (20.37%). Antibiotics were prescribed in 38.15% of patients, with ceftriaxone being most common (54.76%). WHO core indicators showed a higher average number of drugs per encounter (2.10), greater antibiotic (38.2%) and injection use (34.2%), and no prescriptions by generic name or from the Essential Medicines List.

Conclusion: The study highlights those simple febrile seizures were the most common presentation, with clobazam and levetiracetam being the most frequently prescribed AEDs. Monotherapy was preferred, though antibiotic and injection use were higher than WHO recommendations. Co-morbidities such as anaemia and dehydration were common. Overall, the findings emphasize the need for rational prescribing and adherence to WHO indicators in PICU settings.

keywords: ILAE- International league against epilepsy, PICU- Pediatric Intensive Care Unit, Monotherapy, Essential Medicines List, WHO Core prescribing Indicators.

1 INTRODUCTION

A seizure is a sudden, transient disturbance of neurological function caused by abnormal and excessive synchronous firing of neurons in the brain. Seizures range from brief lapses of attention or minor muscle jerks to prolonged convulsions, and a single seizure does not by itself establish a diagnosis of epilepsy; up to 10% of people worldwide will experience one seizure in their lifetime. Epilepsy, in contrast, is characterized by recurrent seizures arising from an enduring predisposition and reflects an imbalance between excitatory (glutamatergic) and inhibitory (GABAergic) neurotransmission. In children, seizures may be provoked by fever, infection, electrolyte or glucose disturbances, hypoxic injury or toxins, or may be unprovoked, and family history, perinatal asphyxia, head trauma and central nervous system infection are recognized risk factors.

Seizures are a frequent reason for intensive care admission. Their reported prevalence in critical care units ranges from 3.3% to 34% depending on the underlying condition, and management is complicated by incomplete histories, sedation, intubation and limited access to electroencephalography. Selecting an antiepileptic drug (AED) requires balancing mechanism of action, dose, efficacy, tolerability, cost, co-morbid illness and the potential for adverse effects and interactions.

Drug utilization research aims to promote rational use of medicines, that is, prescribing a well-evaluated drug, at the right dose, for the right indication, with appropriate information and at reasonable cost. Prescribing audits using the WHO/INRUD core indicators provide a standardized means of identifying irrational practices. Without knowing how drugs are actually being prescribed, it is difficult to recommend changes that make care safer and more economical. The present study was therefore undertaken to analyze and evaluate the prescribing pattern in children with seizures admitted to the PICU of a tertiary care teaching hospital, including adherence to WHO core prescribing indicators.

2 MATERIALS AND METHODS

A cross-sectional observational study was conducted in the Pediatric Intensive Care Unit of the MIMS Teaching Hospital, Mandya Institute of Medical Sciences, Mandya, Karnataka, India. The hospital is a 500-bed tertiary care teaching hospital. The study was carried out over a period of six months. The sample size of 152 were in the study.

2.1 Study Criteria

2.1.1 Inclusion criteria

- Children admitted to the PICU;
- Age between 4 weeks (1 month) and 12 years; and
- Seizures, with or without co-morbid conditions.

2.1.2 Exclusion criteria:

- Age above 12 years; and
- Neonates (first 4 weeks of life).

2.2 Methods of Data Collection

All data were collected using a pretested, semi-structured proforma. For each patient, socio-demographic details (age, sex), diagnosis and seizure type, family history (consanguinity), previous hospitalization, length of hospital stay, co-morbid conditions, and treatment details (drug name, route and formulation, and number of drugs) were extracted from case files, progress records and treatment charts.

2.3 Analysis

Data collected will be coded and checked for completeness and uniformity, then data will be entered in MS Excel worksheet was used and the results were presented as tables, graphs or expressed as percentages according to the type of information collected. For continuous variables, mean and standard deviations will be calculated.

3 RESULTS AND DISCUSSION

A total of 152 children with seizures were enrolled. Their demographic and clinical characteristics are summarized in Table 1.

Table 1: Demographic and clinical characteristics of the study population (n = 152)

Characteristic	No. of patients	Percentage (%)
Sex		
Male	100	65.8
Female	52	34.2
Age group		
1 month to <2 years	70	46.1
2 to <6 years	50	32.9
6 to <9 years	12	7.9
9 to <12 years	20	13.2
Seizure type		
Simple febrile seizure	100	65.8
Breakthrough seizure	30	19.7
Unprovoked seizure	6	3.9
Hypoglycemic seizure	4	2.6
Generalized tonic-clonic seizure	4	2.6
Absence seizure	4	2.6
Convulsion (unspecified)	2	1.3
Complex febrile seizure	2	1.3
Consanguineous marriage of parents		
Yes	24	15.8
No	128	84.2
Previous hospitalization		
Yes	58	38.2
No	94	61.8
Length of hospital stay		
1–3 days	21	13.8
4–6 days	89	58.6
More than 6 days	42	27.6
Co-morbid conditions		
Present	54	35.5
Absent	98	64.5

Percentages are calculated on 152 patients and rounded to one decimal place.

3.1 Gender and age

Of the 152 patients, 100 (65.8%) were male and 52 (34.2%) were female, a male-to-female ratio of about 1.9:1. Most children (78.9%) were younger than six years, with the largest group aged 1 month to under 2 years (46.1%), followed by 2 to under 6 years (32.9%), 9 to under 12 years (13.2%) and 6 to under 9 years (7.9%). The male predominance

agrees with earlier pediatric AED utilization data, in which boys accounted for 54.9% of cases, and with PICU studies reporting more boys than girls. The concentration of cases in early childhood mirrors the peak incidence of febrile seizures and the lower seizure threshold of the developing brain, and is consistent with reports in which the 0-5 year group was most affected and febrile seizures predominated in children aged 1–5 years.

3.2 Seizure type and family history

Simple febrile seizure was the most frequent presentation (65.8%), followed by breakthrough seizure (19.7%). Unprovoked, hypoglycemic, generalized tonic-clonic and absence seizures each accounted for fewer than 4% of cases, and complex febrile seizure and unspecified convulsion for 1.3% each. Parental consanguinity was documented in 24 patients (15.8%). The predominance of febrile seizures is similar to the 73% of typical febrile seizures reported in children aged 1–5 years. Other series have found idiopathic epilepsy or generalized tonic-clonic seizures to be commonest, but these were drug-utilization studies of children and patients with established epilepsy rather than an intensive care population, in which acute, fever-related presentations are expected to be over-represented. Two caveats apply. First, categories such as breakthrough seizure, hypoglycemic seizure and convulsion describe circumstances or semiology rather than ILAE seizure types, so the classification used here is mixed, and EEG or neuroimaging data were not available to refine it. Second, the proportion of children with consanguineous parents is an observation in this cohort; without a comparison group it cannot be interpreted as an association.

3.3 Antiepileptic drugs prescribed

A total of 228 AEDs were prescribed to the 152 patients (mean 1.5 per patient). Benzodiazepines and levetiracetam accounted for most prescriptions: clobazam (42.1%) and levetiracetam (39.5%) together represented 81.6% of all AEDs, followed by sodium valproate (7.9%), midazolam (4.4%), phenytoin (1.8%) and lacosamide (1.8%); topiramate, brivaracetam and perampanel were each prescribed twice (0.9%) (Table 2).

Table 2: Antiepileptic drugs prescribed (total prescriptions = 228)

Drug class	Drug	No. of prescriptions	Percentage (%)
Benzodiazepines	Clobazam	96	42.1
Benzodiazepines	Midazolam	10	4.4
Anticonvulsant (SV2A ligand)	Levetiracetam	90	39.5
Anticonvulsant (SV2A ligand)	Brivaracetam	2	0.9
Aliphatic carboxylic acid	Sodium valproate	18	7.9
Hydantoin derivative	Phenytoin	4	1.8
Sodium channel modulator	Lacosamide	4	1.8
Non-benzodiazepine	Topiramate	2	0.9
AMPA receptor antagonist	Perampanel	2	0.9

Percentages are calculated on the total number of AED prescriptions.

Studies from comparable settings show a similar split between the two leading agents: Clobazam was the most prescribed AED (71%) in febrile-seizure patients aged 1–5 years, whereas Levetiracetam led in other pediatric and general AED utilization series. The combination seen here probably reflects the mix of acute febrile and breakthrough presentations in the PICU. Phenytoin was rarely used (1.8%), in contrast to older utilization data in which it was the second most common monotherapy (11.9%), although the denominators differ. An important point for discussion is that two-thirds of the children had simple febrile seizures. Guidance on simple febrile seizures does not recommend continuous or intermittent anticonvulsant prophylaxis because the potential adverse effects outweigh the benefit. The indication (acute termination versus prophylaxis) and duration of each AED were not captured in this study, so the appropriateness of the high clobazam and levetiracetam use cannot be judged and warrants further evaluation.

3.4 Formulation and pattern of AED therapy

Of 228 AED prescriptions, 110 (48.2%) were tablets, 78 (34.2%) were injections and 40 (17.5%) were syrups. Monotherapy was used in 96 patients (63.2%), dual therapy in 38 (25.0%), triple therapy in 8 (5.3%) and polytherapy in 10 (6.6%) (Table 3).

Table 3: Formulation and pattern of AED therapy

Variable	No.	Percentage (%)
Formulation (n = 228 prescriptions)		
Tablet	110	48.2
Injection	78	34.2
Syrup	40	17.5
Pattern of therapy (n = 152 patients)		
Monotherapy	96	63.2
Dual therapy	38	25.0
Triple therapy	8	5.3
Polytherapy	10	6.6

The substantial share of injectable AEDs is expected in an emergency setting where rapid onset of action and a secured parenteral route are needed, but it exceeds the WHO benchmark discussed in Section 3.7. Tablets formed the largest formulation group even though about four in five children were under six years of age; whether these were dispersible tablets, crushed tablets or another adaptation was not recorded, and the suitability of dosage forms for young children deserves attention. The preference for monotherapy (63.2%) is consistent with paediatric series in which treatment was predominantly monotherapy and with the general principle of using a single, appropriately chosen agent, and it is higher than the 27% reported in a febrile-seizure cohort. The use of more than one AED in more than a third of patients may reflect escalation in persistent or breakthrough seizures and should be reviewed against the response and adverse-effect profile.

3.5 Previous hospitalization, hospital stay and co-morbid conditions

Fifty-eight children (38.2%) had been hospitalized previously and 94 (61.8%) were new admissions. Most patients (58.6%) stayed 4–6 days, 27.6% stayed longer than six days and 13.8% stayed 1–3 days. Co-morbid conditions were present in 54 patients (35.5%). Anaemia was the commonest (33.3% of those with co-morbidities), followed by dehydration (20.4%), lower respiratory tract infection (14.8%), viral fever (11.1%), upper respiratory tract infection (9.3%), meningitis (7.4%) and cystitis (3.7%) (Table 4).

Table 4: Individual co-morbid conditions (n = 54 patients with co-morbidity)

Co-morbid condition	No. of patients	Percentage (%)
Anemia	18	33.3
Dehydration	11	20.4
Lower respiratory tract infection	8	14.8
Viral fever	6	11.1
Upper respiratory tract infection	5	9.3
Meningitis	4	7.4
Cystitis	2	3.7

Percentages are calculated on patients with at least one co-morbid condition.

The typical stay of 4–6 days is comparable to the mean PICU stay of 6.15 days reported in another pediatric PICU cohort and indicates a moderate duration of inpatient care. Anemia and dehydration were the leading associated problems, which is plausible in young children admitted with acute illness, while infections as a group (respiratory, viral fever, meningitis and urinary tract) accounted for 25 of the 54 co-morbid diagnoses (46.3%). These findings underline that seizure management in the PICU is rarely isolated from the treatment of concurrent illness, which in turn increases the number of drugs per patient.

3.6 Antibiotic prescribing

Antibiotics were prescribed to 58 of 152 patients (38.2%); 84 antibiotic prescriptions were issued in total (about 1.4 per treated patient). Ceftriaxone was the most frequently prescribed agent (54.8%), followed by amoxicillin-clavulanate (14.3%), amikacin (11.9%), piperacillin-tazobactam (9.5%), amoxicillin (4.8%), and cefixime and cefalexin (2.4% each) (Table 5).

Table 5: Antibiotics prescribed (total antibiotic prescriptions = 84)

Antibiotic	No. of prescriptions	Percentage (%)
Ceftriaxone	46	54.8
Amoxicillin-clavulanate	12	14.3
Amikacin	10	11.9
Piperacillin-tazobactam	8	9.5
Amoxicillin	4	4.8
Cefixime	2	2.4
Cefalexin	2	2.4

3.7 WHO core prescribing indicators

The average number of drugs per encounter was 2.10, higher than the reference range of 1.6–1.8. Antibiotics were prescribed in 38.2% of encounters (reference 20–26.8%), and 34.2% of AED prescriptions were injectables (reference 13.4–24.1%). Prescribing by generic name and from the Essential Medicines List was recorded as 0% against a reference of 100% for both (Table 6).

Table 6: WHO core prescribing indicators

Indicator	Reference value	Observed value
Average number of drugs per encounter	1.6–1.8	2.10
Encounters with an antibiotic (%)	20–26.8	38.2
Injectable AEDs among AED prescriptions (%)	13.4–24.1	34.2
Drugs prescribed by generic name (%)	100	0
Drugs prescribed from Essential Medicines List (%)	100	0

The injection indicator is expressed here as the proportion of AED prescriptions that were injectables, not as the proportion of encounters with an injection.

A mean of 2.10 drugs per encounter exceeds the WHO range (1.6–1.8) but is considerably lower than in other pediatric inpatient studies, but it is expected due to the severity of illness and polypharmacy in intensive care. The percentage of medicines prescribed by generic name and those from the essential medicines list were not reported, though WHO recommends 100% for both, highlighting areas for improvement. Antibiotics were prescribed in 38.2% of encounters, exceeding the WHO standard of 20–26.8%, reflecting critical care needs, but understanding the importance of antimicrobial stewardship. Use of injections were also higher than WHO benchmark (13.4–24.1%), as 34.2% of AEDs were injectables, which is common in PICU but should be carefully monitored.

3.8 Strengths and limitations

This study provides a snapshot of AED and antibiotic prescribing in children with seizures in a PICU in a resource-limited setting and benchmarks it against WHO indicators. Limitations include the single-centre design, convenience sampling and short duration, which limit generalizability; the absence of data on dose, duration, indication, adverse drug reactions, culture results and clinical outcomes, which precludes assessment of appropriateness and effectiveness; the mixed seizure classification; and the use of WHO indicators that were designed for primary care.

4 CONCLUSION

In this PICU Cross-sectional study, seizures were more frequent in boys and in children under six years of age, and simple febrile seizure was the commonest presentation. Clobazam and levetiracetam accounted for four of every five AED prescriptions, and monotherapy was the preferred approach. Antibiotics, mainly Ceftriaxone, were prescribed to 38.2% of children, and antibiotic use, injectable use and the number of drugs per encounter exceeded WHO reference values, while generic-name and essential-medicine prescribing were not documented. These findings support the need for protocol-based AED selection, antimicrobial stewardship with culture-guided therapy, promotion of generic prescribing and formulary adherence, and periodic prescription audits. Larger multicentre studies that capture indications, dosing, duration, adverse effects and outcomes are recommended to validate these findings and to guide rational prescribing in pediatric seizure care.

STATEMENTS ON COMPLIANCE WITH ETHICAL STANDARDS

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Disclosure of conflict of interest

No Conflict of interest to be disclosed.

Statement of ethical approval

Ethical approval was obtained from institutional ethics committee of Mandya Institute of Medical Science.

Statement of informed consent

Informed consent was obtained from all individual participants guardians included in the study.

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