Treatment Response in Pediatric Patients with Status Epilepticus: A Retrospective Observational Study from Saudi Arabia

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INTRODUCTION

Status epilepticus (SE) is life-threatening pediatric emergency with seizure lasting ≥ 5 minutes, requiring urgent treatment to prevent neurological damage or death.

Despite established guidelines, delay and under-dosing of benzodiazepines (BDZs) and anti-seizure medications (ASM) remain common in patients with SE, contributing to poor outcomes.

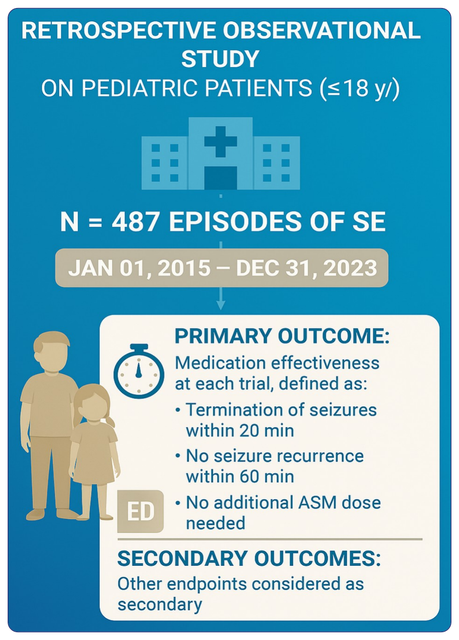
Studies reported increased mortality, ICU admissions, and neurological complications when treatment is delayed or under-dosed.

OBJECTIVE

This study assessed patients' characteristics, etiologies for SE, SE management, responses to BDZs and ASMs, dosing, and treatment failures in pediatric patients.

METHOD

- A retrospective observational study
- Included pediatric patients (≤18 years) with SE admitted to ED at King Khalid University Hospital, between 2015 and 2023
- SE and refractory SE (RSE) were diagnosed according to the American Epilepsy Society (AES) definitions.
- Data collected included demographics, home medications, treatment sequences, medication dosing, and clinical outcomes.
- To assess its appropriateness, administered doses were compared to the AES standards for pediatric patients.
- Descriptive and inferential statistical analyses were conducted for comparisons.



RESULTS

- The study included 487 documented episodes of SE, with a mean age of 6.1 ±4.1 years.
- Most patients were males (57.3%) with a documented history of epilepsy (74.1%).
- Benzodiazepines (BDZs) were administered first in 83.0% of the cases with only 10.9% success rate, while anti-seizure medications (ASMs) were used first in only 17.0% with 66.3% success rate (p<0.0001).
- Surprisingly, appropriately dosed medications overall were significantly less effective than those under-dosed (33.5% vs. 46.8%, p=0.0222), mainly due to poor response to BDZs
- Levetiracetam was the most effective ASM on any trial, with 75.0% success rate.
- Younger patients and those who initiated therapy on BDZ had higher hospital admission rates.

Table 1. Demographics, possible etiologies for the SE episodes, and home medications

Characteristics	Overall (N=487)
Age, years (mean ± SD)	6.1 ±4.1
Weight, Kg	20.8 ±13.0
Body Mass Index, Kg/m²	16.5 ±3.9
Gender	
Male	279 (57.3)
Female	208 (42.7)
History of epilepsy	361 (74.1)
Documented etiologies*	
Infection	77 (15.8)
Non-compliance to ASMs	42 (8.6)
Trauma	13 (2.7)
Hypoglycemia	10 (2.1)
Poor sleep hygiene	9 (1.8)
Change in ASMs	6 (1.2)
Unknown reason	306 (62.8)
Home medication(s)*	
Levetiracetam	248 (50.9)
Carbamazepine	85 (17.5)
Topiramate	65 (13.3)
Valproic acid	62 (12.7)
Phenobarbital	58 (11.9)
Lamotrigine	19 (3.9)
Phenytoin	8 (1.6)
Vigabatrin	8 (1.6)
No previous treatment	150 (30.8)

* Some patients had more than one home medication or more than one possible etiology while others have no home medication or no documented etiology.

Table 2. The number and percentage of medications' trials and its success in terminating SE episodes on each trial

Medication	Trial # 1 resolved/total	Trial # 2 resolved/total	Trial # 3 resolved/total	Trial # 4 resolved/total
Overall (BDZ/ASMs)	99/487 (20.3)	203/388 (52.3)	97/185 (52.4)	42/88 (47.7)
BDZ (n,%)	44/404 (10.9)	28/161 (17.4)	18/62 (29.0)	9/33 (27.3)
Lorazepam	37/360 (10.3)	17/124 (13.7)	8/36 (22.2)	2/17 (11.8)
Midazolam	2/24 (8.3)	9/24 (37.5)	10/23 (43.5)	4/12 (33.3)
Diazepam	5/20 (25.0)	2/13 (15.4)	0/3 (0.0)	3/4 (75.0)
ASMs (n,%)	55/83 (66.3)	175/227 (77.1)	79/123 (64.2)	31/53 (58.5)
Levetiracetam	44/58 (75.9)	117/146 (80.1)	50/64 (78.1)	10/18 (55.6)
Phenobarbital	1/7 (14.3)	11/20 (55.0)	9/19 (47.4)	1/6 (16.7)
Phenytoin	9/17 (52.9)	43/57 (75.4)	20/40 (50.5)	19/28 (67.9)
Valproate	1/1 (100.0)	4/4 (100.0)	---	1/1 (100.0)
Sedation (n,%)*	---	---	---	2/2 (100.0)

* The sedation was induced using midazolam infusion.

Table 3. Outcomes of care based on patients' characteristics and treatment used on first trial

Variable & Categories		Deposition status from ED		p-value
	Categories	Discharged from ED	Admitted to Hospital	
Overall		191/487 (39.3)	296/487 (60.7)	
Age, years		7.1 ±4.0	5.5 ±4.4	**<0.0001**
Gender	**Male**	109/279 (39.1)	170/279 (60.9)	0.9367
	Female	82/208 (39.4)	126/208 (60.6)	
History of epilepsy	**No**	24/126 (19.0)	102/126 (81.0)	**<0.0001**
	Yes	167/361 (46.3)	194/361 (53.7)	
Medication used first	**BDZs (n= 404)**	146/404 (36.1)	258/404 (63.9)	**0.0021**
	ASMs (n= 83)	45/83 (54.2)	38/83 (45.8)	
Dosing of medication	**Appropriate (n= 385)**	150/385 (39.0)	235/385 (61.0)	0.0222
	Under-dosed (n= 102)	41/102 (40.2)	61/102 (59.8)	
Length of stay, days		0.4 ±0.3	13.5 ±61.9	**0.0003**

Results are presented as mean ±SD or frequency (%)
Abbreviations: BDZ: benzodiazepines; ASM: anti-seizure medication.

Table 4. Response to BDZs or ASMs on first trial based on demographic characteristics

Variable & Categories		Response on first trial		p-value
	Categories	Did not respond	Responded	
Age, years		6.1 ±4.1	6.3 ±4.1	0.5933
Gender	**Male**	216 (77.4)	63 (22.6)	0.1526
	Female	172 (82.7)	36 (17.3)	
History of epilepsy	**No**	106 (84.1)	20 (15.9)	0.1489
	Yes	282 (78.1)	79 (21.9)	
Medication used	**BDZ**	360 (89.1)	44 (10.9)	**<0.0001**
	ASM	28 (33.7)	55 (66.3)	
Dosing of medication	**Appropriate (n= 385)**	315 (81.8)	70 (18.2)	0.0222
	Under-dosed (n= 102)	73 (71.6)	29 (28.4)	

Results are presented as mean ±SD or frequency (%)
Abbreviations: BDZ: benzodiazepines; ASM: anti-seizure medication.

CONCLUSIONS

- ASMs were more effective than BDZs when managing pediatrics with SE, regardless of dosing precision.
- These findings point towards adoption of personalized treatment strategies and may warrant early switching to ASMs.
- National multicenter research is needed to define a standardized pediatric SE protocol and improve outcomes in Saudi Arabia.

CONTACT INFORMATION

For any question or inquiry about the study, contact the presenting author Dr. Omar Almohammed (oalmohammed@ksu.edu.sa)

For the full results of the study, you can read the published paper @