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CASE REPORT

Progression of pediatric febrile seizure to status epilepticus: A case report

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Abstract

Managing pediatric febrile seizures progressing into status epilepticus (SE) presents challenges due to diagnostic complexities and the evolving nature of symptoms. This case report presents the management of a 1-year-old pediatric patient who experienced a febrile seizure progressing into SE. Laboratory findings reflected common variations observed in febrile illnesses and seizures. Treatment comprised a multidrug regimen involving antibiotics, anticonvulsants, and supportive care, primarily focused on seizure control, infection management, and symptomatic relief, aligning with established protocols for SE management in pediatric patients. However, the potential for drug interactions, particularly with carbapenems, underscores the importance of medication selection, especially in patients predisposed to seizures or neurological complications. This case report emphasizes the necessity for a multidisciplinary approach involving pediatricians, neurologists, and clinical pharmacists in optimizing treatment strategies for SE. The involvement of clinical pharmacists in medication review, dosage adjustments, monitoring for drug interactions, and patient education played a pivotal role in achieving positive outcomes in this critical scenario. This report sheds light on the complexities and challenges inherent in managing pediatric febrile seizures advancing to SE and underscores the significance of collaborative, multidisciplinary care in such cases.

Keywords: Febrile status epilepticus; Pediatric seizures; Multi-drug regimen; Neurological complications

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1. Introduction

Febrile seizures manifest as sudden convulsions triggered by a rapid elevation in body temperature, typically surpassing 38°C (100.4°F), without underlying seizure-inducing conditions such as central nervous system infections, electrolyte imbalances, drug withdrawal, trauma, genetic predisposition, or known epilepsy. These seizures are categorized as either simple or complex febrile seizures, with each subclassification requiring distinct approaches and assessments.[1-3]

Febrile seizures often arise in conjunction with a temperature exceeding 38°C (100.4°F) and in the absence of other seizure-provoking factors, although the convulsive temperature threshold varies among individuals. They frequently coincide with the rise in body temperature, serving as an early indication of an underlying illness, with

viral infections, notably HHV-6 in the United States and European countries, and influenza A virus in Asian regions, commonly associated with febrile seizures. Nonetheless, any substantial fever can incite a febrile seizure.[3,4]

Febrile seizures are prevalent among children aged 6 months to 5 years, affecting up to 4% of this demographic. While some children may experience a single febrile seizure, others may endure multiple occurrences during early childhood. However, the precise pathophysiology of febrile seizures remains elusive. A hereditary predisposition exists, with 10 – 20% of first-degree relatives of affected patients also experiencing febrile seizures, although the mode of inheritance remains undefined.[5]

No specific treatment exists for simple or complex febrile seizures other than addressing underlying febrile illnesses. Antipyretics have not demonstrated efficacy in preventing recurrent febrile seizures. Studies examining the use of benzodiazepines as a short-term measure during subsequent febrile events in patients with frequent recurrences have been conducted. Febrile status epilepticus (FSE), occurring in <10% of initial febrile seizures, warrants immediate intervention using rectal diazepam or intranasal midazolam if the event exceeds 5 min. Such patients face an increased risk of future episodes.[6-8]

While most febrile seizure cases do not necessitate hospitalization or extensive intervention, prolonged complex febrile seizures may result in Todd's paralysis, which is characterized by focal weakness that typically resolves within hours to days. Notably, patients with febrile seizure status, defined as seizures lasting over 30 min, require immediate treatment akin to prolonged seizures from other causes. It is essential to promptly broaden the differential diagnosis if a patient fails to regain consciousness or exhibits unexpected neurological abnormalities post-seizure.[9,10]

These cases warrant evaluation for ongoing seizure activity or other intracranial abnormalities, often necessitating prolonged electroencephalogram (EEG) studies and further investigations for potential underlying pathologies. Collaborative management involving pediatricians and neurologists is essential for diagnosing and managing febrile seizures. Patient education plays a crucial role in mitigating unnecessary emergency room visits and avoiding unverified remedies. Parents should be informed about when to seek emergency care and cautioned against using aspirin for fever management. The unified approach of the interprofessional team ensures comprehensive care for patients experiencing febrile seizures. The prognosis for most children with febrile seizures is favorable, with approximately 30% experiencing subsequent seizures. While there is a slightly elevated risk of future epilepsy, febrile seizures typically do not impair cognition or intellect or induce neurological dysfunction.[11,12]

2. Case presentation

FSE represents a critical manifestation of febrile seizures, characterized by episodes lasting 30 min or more. This case delves into a 1-year-old baby boy admitted to the pediatric department weighing 12 kg, presenting a 5-day history of fever, vomiting, cough, and a severe seizure episode lasting 20 – 25 min. This seizure episode was marked by ocular deviation, frothing of the mouth, and generalized tonic-clonic features. Upon admission, clinical examination revealed a temperature of 102°F, a heightened heart rate of 162 bpm, and a respiratory rate of 24/min. Over 3 days, hematological and biochemical assessments as shown in Table 1 revealed fluctuating levels, including hemoglobin readings (12 – 11.8 g/dL; normal range: 11 – 15.5 g/dL); red blood cell counts (4.7 and 4.8 million/cumm; normal range: 4 – 5.2 million/cumm); white blood cell counts (40.9 – 9.6 thousand cells/cumm; normal range: 5 – 13 thousand cells/cumm); and platelet counts (3.24 and 2.19 lakhs cells/cumm; normal range: 1.8 – 4.5 lakhs cells/cumm) as shown in Table 2. In addition, electrolyte imbalances were observed with sodium levels of 137 – 141 mmol/L (normal range: 136 – 145 mmol/L), potassium levels of 3.3 – 4.3 mmol/L (normal range: 3.5 – 5 mmol/L), and chloride levels of 99 – 105 mmol/L (normal range: 95 - 105 mmol/L) as shown in Table 3. Renal function tests reflected normal blood urea nitrogen (BUN) and serum creatinine (Sr. Cr) levels within standard ranges as shown in Table 4. The diagnostic process included a magnetic resonance imaging (MRI) scan that exhibited normal myelination. Treatment encompassed a multidrug approach involving antibiotics (injection ceftriaxone, injection meropenem, and injection linezolid), anticonvulsants (injection levetiracetam, tablet clobazam, and syrup levetiracetam), and supportive care as shown in Table 5. Throughout the hospital stay, the patient experienced varying symptoms, including high-grade fever spikes, vomiting, decreased cough, and cold. Adjustments to the medication regimen resulted in reduced fever spikes, cessation of vomiting, and the absence of new complaints. Ultimately, the patient remained afebrile and active for 48 h before discharge. The subjective assessment on admission outlined a 1-year-old male admitted to the pediatric intensive care unit due to fever, seizures, vomiting, and loose stools, with objective findings indicating normal laboratory parameters. The tailored treatment approach led to discharge upon symptom reduction and minimized fever spikes. Notably, the patient had potential severe drug interactions with carbapenems, warranting caution in

Table 1. Biochemistry test

Biochemistry	Day 2	Normal values
Serum Ca^{+2}	9.9	3.8 – 10.6
Serum Mg^{+2}	2.5	1.6 – 2.6

Table 2. Complete blood picture

Hematology	Day 1	Day 3	Day 5	Normal values
Hemoglobin	12	12	11.8	11 – 15.5 g/dL
Red blood cells	4.7	4.8	4.7	4 – 5.2 million/cumm
White blood cells	40.9	18.5	9.6	5 – 13 thousand cells/cumm
Platelets	3.24	2.19	2.35	1.8 – 4.5 hundred thousand cells/cumm

Table 3. Electrolytes test

Electrolytes	Day 1	Day 3	Normal values
Na^{+}	137	141	136 – 145 mmol/L
K^{+}	3.3	4.3	3.5 – 5 mmol/L
Cl^{-}	99	105	95 – 105 mmol/L

Table 4. Renal function test (RFT)

RFT	Day 3	Normal values
BUN	14	10.8 – 38.4
Sr.Cr	0.3	0.2 – 0.4
Uric acid	1.1	3.5 – 7.2

Abbreviations: BUN: Blood urea nitrogen; Sr.Cr: Serum creatinine.

patients prone to seizures or neurological disturbances. Patient counseling focused on understanding febrile seizures, recognizing signs, adopting preventive measures, and knowing when to seek medical attention.

3. Discussion

FSE represents a critical end of the spectrum in febrile seizures, characterized by seizures lasting over 30 min. It poses significant challenges, especially in pediatric patients, necessitating immediate and tailored interventions.[1-3] A 1-year-old baby boy was admitted with a 5-day history of high-grade fever, vomiting, cough, and a seizure lasting 20 – 25 min, displaying ocular deviation and generalized tonic–clonic features. Upon examination, he presented with a temperature of 102°F, an elevated heart rate of 162 bpm, and a respiratory rate of 24/min. Hematological and biochemical investigations revealed fluctuating parameters, including variations in hemoglobin, red blood cell, white blood cell, and platelet counts. In addition, electrolyte imbalances were observed. Imaging through MRI revealed normal myelination. Treatment encompassed a combination of antibiotics, anticonvulsants, and supportive care, leading to a gradual resolution of symptoms. The patient achieved a 48-h afebrile state and was discharged with modified medication. The case highlights the complexity of managing FSE in pediatric patients. The prolonged seizure episode, along with the constellation of symptoms, posed diagnostic and therapeutic challenges. Laboratory findings indicated fluctuations in hematological parameters and electrolyte

Table 5. Treatment chart

Drug given	Dose	Roa	Frequency	Pediatric dosing
Injection ceftriaxone	500 mg	Intravenous	Bd	50 mg/kg/day
Injection pantoprazole	10 mg	Intravenous	Od	10 – 20 mg/day
Injection ondansetron	1 cc	Intravenous	Bd	0.1 mg/kg
Injection levetiracetam	200 mg (S)/50 mg	Intravenous	Bd	10 mg/kg/day
Tablet clobazam	5 mg	Oral	Bd	10 mg/kg/day
Syrup Paracetamol	3 ml	Oral	Qid	10 – 15 mg/kg
Syrup Cetirizine+Ambroxol	3 ml	Oral	Bd	-
Paracetamol suppository	170 mg	Rectal	Sos	-
Iv infusion of ½ dextrose normal saline	40 mL/h	Intravenous		-
3% Normal saline nebulization	2 drops E/S 3 cc	Nasal	Tid	-
Injection meropenem	200 mg	Intravenous	Tid	20 mg/kg
Injection linezolid	100 mg	Intravenous	Bd	10 mg/kg
Bacillus clausii capsule	1 capsule	Oral	Bd	-
Syrup levetiracetam	0.5 ml	Oral	Bd	10 mg/kg/day

Abbreviations: Bd: Twice daily; E/S: Each side; Iv: Intravenous; ns: Normal saline; Od: Once daily; Roa: Route of administration; Sos: Whenever required; Syp: Syrup; Tid: Thirce daily.

imbalances, common in febrile illnesses and seizures. The treatment regimen aimed at controlling seizures, managing infection, and providing symptomatic relief, aligning with established protocols for FSE management.

The dynamic nature of the patient's symptoms throughout the hospital stay underscores the importance of closely monitoring these cases. Adjustments in medication were crucial in mitigating fever spikes, controlling seizures, and reducing associated symptoms. The normalization of laboratory parameters and the resolution of clinical signs contributed to the decision for discharge. However, the case also revealed potential drug interactions, particularly with carbapenems, emphasizing the need for careful consideration of medication choices, especially in patients predisposed to seizures or neurological complications. This underscores the significance of a multidisciplinary approach involving pediatricians, neurologists, and pharmacists in optimizing treatment strategies.

In cases of FSE involving pediatric patients, the role of clinical pharmacists is indispensable in optimizing medication regimens and ensuring treatment effectiveness while mitigating potential risks associated with drug interactions. These professionals conduct comprehensive medication reviews, critically evaluating prescribed drugs, including antibiotics, anticonvulsants, and supportive care medications, to prevent adverse reactions and enhance therapeutic outcomes.[4-6] Clinical pharmacists provide valuable insights into dosing regimens, aligning medications with the patient's age and weight and suggesting alternative therapies to minimize drug interactions and potential complications. The complex nature of administering multiple medications, especially in critical scenarios like FSE, heightens the risk of drug interactions, particularly with compounds such as carbapenems. Clinical pharmacists excel in identifying potential interactions and guiding necessary adjustments or alternate medication options. Their vigilance extends to actively monitoring patients for signs of adverse reactions or drug interactions throughout the treatment trajectory, ensuring timely intervention to prevent complications. Education and counseling are fundamental aspects of a clinical pharmacist's role. They educate caregivers about medication usage, potential side effects, and the significance of adhering to the treatment plan. In cases like FSE, where managing seizures and fever is paramount, pharmacist-led guidance empowers caregivers to recognize warning signs, respond during emergency seizures, and adhere strictly to the prescribed medication regimen. The collaborative efforts of clinical pharmacists within the healthcare team, involving pediatricians, neurologists, and other specialists, are instrumental. They contribute invaluable perspectives in multidisciplinary discussions, aligning therapeutic plans with the patient's clinical condition to minimize adverse events and optimize treatment strategies.

FSE, where precise medication management is critical, underscores the pivotal role of clinical pharmacists in ensuring safe and effective pharmacotherapy. Their involvement significantly contributes to improved patient outcomes and reduced likelihood of medication-related complications, highlighting their indispensable role in pediatric care. FSE poses a serious health concern in pediatric patients, necessitating prompt recognition, appropriate interventions, and meticulous monitoring.[7-9] This case report emphasizes the challenges encountered in managing FSE, ranging from diagnosis to treatment modifications. Tailored therapeutic strategies, vigilant monitoring, and an understanding of potential drug interactions are pivotal for achieving favorable outcomes in such cases.

The evaluation and management of febrile seizures in children involve a nuanced approach to determine the underlying cause and ensure appropriate interventions.[1,13]

3.1. Diagnostic investigations

The two sources highlight varying recommendations for diagnostic investigations in the context of febrile seizures. The first source discourages routine tests such as full blood count, electrolytes, and glucose levels unless clinically indicated, emphasizing that these parameters do not alter the management course of febrile seizures. In contrast, the second source presents a more detailed approach, suggesting lumbar puncture in specific scenarios, especially for young infants and cases with suspected meningitis.[14-16]

3.2. Neuroimaging and EEGs

The recommendations on neuroimaging and EEGs also differ. The first source advocates against routine neuroimaging for febrile seizures, suggesting it is rarely needed for simple cases.[13,17] On the other hand, the second source acknowledges specific situations where neuroimaging and EEG might be considered, especially for children with recurrent or complex febrile seizures.[18,19]

3.3. Treatment and prevention

Both sources discuss the use of benzodiazepines for seizures, but the second source provides a more nuanced perspective on their efficacy in febrile seizures. It emphasizes the uncertain efficacy of benzodiazepines in febrile seizures while acknowledging their accepted use in FSE.[20-22] In addition, the second source introduces the consideration of antipyretics and their limited impact on febrile seizure recurrence.[22,23]

3.4. Evaluation

The second source introduces the concept of "red flags" for febrile seizures, emphasizing specific signs that warrant further evaluation, such as complex febrile seizures,

meningeal signs, and abnormal neurological findings. This adds a practical dimension to identifying high-risk cases.[24]

3.5. Management

While both sources touch upon the management of febrile seizures, the second source provides additional insights into the psychological impact on families and emphasizes the importance of reassurance and education. It also details the acute phase treatment, including considerations for prolonged seizures and when to seek medical assistance.[25] The comparison highlights variations in recommendations and perspectives in the evaluation and management of febrile seizures. While both sources provide valuable insights, the nuanced approach presented in the second source, along with specific considerations and red flags, offers a more comprehensive guide for clinicians dealing with this common childhood condition. These differences underscore the evolving nature of clinical guidelines and the need for a case-specific, patient-centered approach in managing febrile seizures in children.

4. Conclusion

This case report of FSE in a pediatric patient illuminates the intricate landscape and challenges associated with managing critical conditions in children. The multidimensional aspects of diagnosis and treatment, as detailed in the report, underscore the indispensable role of clinical pharmacists in optimizing medication strategies. The achievement of a 48-h afebrile state signifies the effectiveness of the optimized treatment protocol implemented. Notably, the report emphasizes the pivotal contribution of clinical pharmacists, showcasing their expertise in medication review, dosage adjustment, drug interaction assessment, and patient counseling. The collaborative health-care approach involving pediatricians, neurologists, and clinical pharmacists proves essential in navigating the complexities of pediatric febrile seizures progressing to status epilepticus (SE). The rationale behind the choice of anti-seizure medications, specifically levetiracetam and clobazam, is elucidated, with evidence-based support. The dynamic nature of the patient's symptoms underscores the necessity for close monitoring and adaptive medication adjustments. Furthermore, the recommendation for a follow-up in the pediatric outpatient department post-discharge is highlighted as crucial for ongoing evaluation and potential regimen adjustments, aligning with standard care practices. Together, these key points convey the profound significance of collaborative healthcare, the vital role of clinical pharmacists, evidence-based decision-making, and the nuanced complexities involved in managing pediatric febrile seizures evolving into SE.

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Conflict of interest

The authors declare that they have no conflict of interest.

Author contributions

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Writing – original draft: All authors
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Ethics approval and consent to participate

Not applicable.

Consent for publication

A written informed consent was obtained from the patient.

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