

# Practice variability in the management of complex febrile seizures by pediatric emergency physicians and fellows

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## ABSTRACT

**Objective:** Febrile seizures are the most common type of childhood seizure and are categorized as simple or complex. Complex febrile seizures (CFSs) are defined as events that are focal, prolonged (> 15 minutes), or recurrent. The management of CFS is poorly defined. The objective of this study was to determine the degree of variability in the emergency department evaluation of children with CFSs.

**Methods:** An online survey questionnaire was developed and sent to physicians identified via the listserv of the emergency medicine section of the American Academy of Pediatrics and the pediatric emergency medicine discussion list. The questionnaire consisted of five hypothetical case vignettes describing children under 5 years of age presenting with a CFS. Following review of the first four vignettes, participants were asked if they would (1) obtain blood and urine for evaluation; (2) perform a lumbar puncture; (3) perform neurologic imaging while the child was in the emergency department; (4) admit the child to the hospital; or (5) discharge with follow-up as an outpatient, with either the primary care provider or a neurologist. The final vignette determined if antiepileptic medication would be prescribed by the physician on discharge.

**Results:** Of the 353 physicians who participated, 293 (83%) were pediatric emergency medicine attending physicians and 60 (17%) were pediatric emergency medicine fellows. Overall, 54% of participants indicated that they would obtain blood for evaluation, 62% would obtain urine, 34% would perform a lumbar puncture, and 36% would perform neurologic imaging. The overall hypothetical admission rate for the case vignettes was 42%.

**Conclusions:** This study indicates that extensive variability exists in the emergency department approach to patients with CFS. Our findings suggest that optimal management for CFS remains unclear and support the potential benefit of future prospective studies on this subject.

## RÉSUMÉ

**Objectif:** Les convulsions fébriles sont le type le plus commun de convulsions infantiles. Elles sont dites simples ou complexes. Les convulsions fébriles complexes (CFC) sont définies comme des événements localisés, prolongés (> 15 minutes) ou récurrents. La prise en charge des CFC est mal définie. L'objectif de cette étude était de déterminer le degré de variabilité, dans les services d'urgence, des évaluations des enfants présentant des CFC.

**Méthode:** Un questionnaire en ligne d'une page a été élaboré et envoyé aux médecins identifiés par le biais du serveur de listes de la section de médecine d'urgence de l'American Academy of Pediatrics et de la liste de discussion en médecine d'urgence pédiatrique. Le questionnaire comportait cinq vignettes de cas hypothétiques décrivant des enfants de moins de 5 ans présentant une CFC. Après avoir pris connaissance des quatre premières vignettes, les participants devaient indiquer s'ils allaient (1) obtenir un échantillon de sang et d'urine aux fins d'évaluation; (2) effectuer une ponction lombaire; (3) réaliser une imagerie neurologique pendant que l'enfant était à l'urgence; (4) hospitaliser l'enfant; (5) lui donner son congé avec un suivi en clinique externe, soit avec son fournisseur de soins primaires ou avec un neurologue. La dernière vignette déterminait si le médecin prescrirait un antiépileptique au moment du congé du jeune patient.

**Résultats:** Parmi les 353 médecins qui ont participé à l'étude, 293 (83 %) étaient des médecins traitants en médecine d'urgence pédiatrique et 60 (17 %) étaient des moniteurs cliniques en médecine d'urgence pédiatrique. Dans l'ensemble, 54 % des participants ont indiqué qu'ils obtiendraient un échantillon de sang aux fins d'évaluation, 62 % obtiendraient un échantillon d'urine, 34 % effectueraient une ponction lombaire, et 36 %, une imagerie neurologique. Le taux d'hospitalisation global hypothétique était de 42 %.

**Conclusion:** Cette étude met en lumière une grande variabilité dans la prise en charge à l'urgence des jeunes patients

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présentant des convulsions fébriles complexes. Nos constatations suggèrent que la prise en charge optimale des CFC reste floue et appuient les bénéfices potentiels que de futures études prospectives sur ce sujet pourraient apporter.

Febrile seizures are the most common type of childhood seizure and a frequent reason for emergency department (ED) visits. Febrile seizures are categorized as simple or complex: simple febrile seizures are generalized seizures that last less than 15 minutes and do not recur within 24 hours, whereas complex febrile seizures (CFSs) are defined as events that are focal, prolonged (> 15 minutes), or recurrent.<sup>1,2</sup> It is estimated that between 2 and 5% of children under 5 years of age will experience a febrile seizure, 20% of which are complex.<sup>3,4</sup> The two forms of febrile seizures may arise from biologically distinct conditions with different risks for morbidity and mortality.<sup>5</sup> Significant research has been performed on the pathogenesis and prognosis of simple febrile seizures, leading to consensus statements regarding their evaluation and management. However, the management of CFS remains poorly defined.

The objective of this study was to determine the degree of variability in the ED evaluation of children with CFSs.

## METHODS

### Study design

#### Survey instrument

An online survey questionnaire was developed by the study authors and a pediatric epileptologist based on the American Academy of Pediatrics (AAP) definition of a CFS. It was pilot tested on a convenience sample of 10 pediatric emergency medicine attending physicians and one pediatric epileptologist at the coordinating hospital. The survey instrument was subsequently modified to correct poor wording and design flaws. The questionnaire consisted of five hypothetical case vignettes (Table 1).

Each case vignette described a child less than 5 years of age with either a prolonged seizure, a focal seizure, or a recurrent seizure.<sup>2</sup> In all cases, participants were instructed that the child was developmentally normal and had no previous seizure episodes. Following the first four vignettes, multiple choice questions were asked regarding whether practitioners would (1) obtain blood and urine for evaluation; (2) perform a lumbar

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**Table 1. Case vignettes used to assess evaluation and management of complex febrile seizures**

1. A 2-year-old female was brought to the ED by her parents after she experienced an episode described as right upper extremity clonus. It lasted approximately 60 seconds. She had been having fevers at home to 40°C for the day prior to the episode. The patient appears well on examination, with normal physical findings and without focal neurologic deficits.
2. A 3-year-old male experienced a 10-minute generalized tonic-clonic seizure at home. Six hours later, while awaiting evaluation in the ED, he experienced a second generalized tonic-clonic seizure that lasted 5 minutes. In the ED, he had a temperature of 40°C. Although mildly postictal, the child appears well, with a normal physical and neurologic examination.
3. An 18-month-old female experienced a 30-minute generalized tonic-clonic seizure at home. In the ED, she had a temperature to 39.7°C. She appears well on examination, without focal neurologic deficits.
4. If the patient in question 3 was an 8-month-old child?
5. Following an evaluation of a 3-year-old with a complex febrile seizure, it is decided to discharge the patient from the ED with neurology follow-up. Would you prescribe an antiepileptic medication?

ED = emergency department.

puncture; (3) perform neurologic imaging while the child was in the ED; (4) admit the child to the hospital; or (5) discharge with follow-up as an outpatient, with either the primary care provider or a neurologist. The final vignette determined if antiepileptic medication would be prescribed by the physician on discharge. The options to answer “other” and “additional tests performed” were allowed for participants who felt that the other choices did not reflect their practice approach; participants were asked to elaborate on such an answer in full text. All full-text responses were entered into the database and subsequently examined. It was decided a priori that if a significant number of participants entered similar responses in full text, the database categories would be revised to reflect these responses.

Demographic information obtained included physician category (general pediatrics attending physician, pediatric emergency medicine attending physician, pediatric emergency medicine fellow, emergency medicine attending physician, or emergency medicine resident), site of practice, number of years since

graduation from medical school, and number of years of practice in a specialty (when applicable).

### **Study protocol and population**

Access to the survey instrument was sent to physicians through the listerv of the emergency medicine section of the AAP and the pediatric emergency medicine discussion list. All physicians belonging to these listservs were eligible for participation. Two weeks after sending the first request through the listerv, a second request was made in an attempt to maximize enrolment. The study was coordinated by Phoenix Children's Hospital, a free-standing facility with an annual ED census of 60,000 patients. The hospital's Institutional Review Board granted ethics approval for the study.

### **Data entry and analysis**

Data analysis was performed using SPSS version 16.0 (SPSS Inc, Chicago, IL). Standard descriptive statistics response frequency counts were used as appropriate.

## **RESULTS**

Of the 369 physicians who responded, 293 (79%) were pediatric emergency medicine attending physicians and 60 (16%) were pediatric emergency medicine fellows. Because only 16 (4%) general emergency physicians participated, their responses were not included in the data analysis, leaving a total sample of 353 participants. Of these, 62% worked in a dedicated children's hospital and 58% worked within their subspecialty for more than 6 years (Table 2).

Overall, when the four vignettes were examined collectively, a consistent practice pattern across responders was not found. Fifty-four percent of participants indicated that they would obtain blood for evaluation, whereas 62% would obtain urine. Thirty-four percent indicated that they would perform a lumbar puncture, and 36% indicated that they would perform neurologic imaging. The overall hypothetical admission rate for the case vignettes was 42%.

When categorized by the definitional criteria of CFS and patient age, there was wide variation in responses (Table 3). If focality of the seizure was used as the defining variable, neurologic imaging studies would be obtained in 61% of patients versus 19 to 35% for other defining variables. The hypothetical admission rate for this group was only 19%, in contrast to 42 to 60% for

**Table 2. Characteristics of participants**

Characteristic	%
Years in specialty	
5 or less	41.7
6 to 10	19.7
11 or more	39.6
Years since medical school graduation	
5 or less	9.6
6 to 10	47.6
11 or more	42.8
Site of practice	
General emergency department	9.3
Pediatric emergency department within a general hospital	27.5
Children's hospital	61.5

the other categories. The case vignette of a child with recurrent seizures had the lowest rate of neurologic imaging performance (20%). If the criterion for defining a febrile seizure as complex was the length of the seizure, then the age of the child influenced what evaluation participants indicated they would perform. A child less than 12 months of age was more likely to have a lumbar puncture performed (63% versus 29%). This group also had the highest admission rate at 60%.

Only 19 participants (5%) indicated that they would commence the patient in the final vignette on an antiepileptic medication as an outpatient. Of these, 16 indicated that they would prescribe an as needed antiepileptic medication (rectal diazepam), and 4 indicated that they would commence the patient on a regular maintenance dose of antiepileptic medication (phenobarbital or sodium valproate) until the patient was seen by a neurologist.

## **DISCUSSION**

CFSs are a frequent reason for ED visits. Unfortunately, because evidence is lacking, consensus does not exist on the management or treatment of this condition. To our knowledge, this study is the first to evaluate the approach to CFSs taken by pediatric emergency physicians. Our results indicate that significant practice variability exists in this area.

Although we expected some degree of variation in physicians' management of the case vignettes we presented to them, our study adds to the literature in this area by underscoring the need for prospective research and the development of clinical practice guidelines.

**Table 3. Participants' responses to vignette management questions categorized by CFS definitional criteria and patient age**

Response	Criteria defining event as a complex febrile seizure, n/N (%)			
	Focal	Recurrent	Prolonged (> 12 mo of age)	Prolonged (< 12 mo of age)
Obtain blood for evaluation	160/353 (45.3)	156/353 (44.2)	204/353 (57.8)	240/353 (68)
Obtain urine for evaluation	220/353 (62.3)	84/353 (23.8)	284/353 (80.5)	298/353 (84.4)
Perform a lumbar puncture	84/353 (23.8)	78/353 (22.1)	102/353 (28.9)	221/353 (62.6)
Perform neurologic imaging	215/353 (60.9)	69/353 (19.5)	100/353 (28.3)	123/353 (34.8)
Admit the child to hospital	66/353 (18.7)	148/353 (41.9)	172/353 (48.7)	211/353 (59.8)

CFS = complex febrile seizure.

The AAP developed a practice parameter for the neurodiagnostic evaluation of the child with a first simple febrile seizure.<sup>2</sup> In reality, these recommendations appear to be used similarly if a child has a CFS, albeit with a more aggressive diagnostic evaluation. However, unlike in children with simple febrile seizures, our findings indicate that a predisposition exists toward admitting children following CFSs.

Although not directly examined in our study, a reflection on the potential concerns that may influence a decision to admit a patient with febrile seizures is warranted. The most important part of the evaluation arising from a thorough history and physical examination is to search for the source of the child's fever. Numerous studies over several decades support the conclusion that laboratory investigations are unhelpful in the management of a child with a febrile seizure, with the exception of cases involving specific conditions such as vomiting and diarrhea.<sup>2,6-9</sup> The vignettes presented in our study involved different genders and ages, making an assessment in the variability of use of laboratory tests difficult. A further evaluation of this question through prospective cohort studies could help elucidate the value of various diagnostic tests and their impact on physician decision making.

Numerous studies indicate that routine emergency neurologic imaging, in the absence of such things as a history of trauma or signs of elevated intracranial pressure, is unnecessary for children presenting with both simple and complex febrile seizures.<sup>10-14</sup> Our results suggest that many children may still be receiving this evaluation on ED presentation.

Our study did identify some consistency with respect to certain factors. For example, 95% of participants indicated that they would not start a hypothetical patient on an antiepileptic medication, and of those who would, most stated that they would prescribe medication as needed rather than a regular maintenance dose. Our result categorization by the definitional criteria of CFS and patient age also suggested that some consistencies exist. For example, the vast majority of participants (> 80%) indicated that they would order a urine evaluation for prolonged seizures; the vast majority (> 80%) would not admit the child based on focality; a minority (< 20%) would order neurologic imaging for recurrent seizures; and a minority (< 25%) would order urine evaluation or a lumbar puncture for recurrent seizures or perform a lumbar puncture because of a focal seizure. Another noteworthy pattern is that all practices examined were performed more often among patients < 12 months of age with prolonged CFS, except for neurologic imaging. Further studies should investigate some of these patterns more closely in the context of the criteria defining a febrile seizure as complex. The logical next step would be to evaluate the value of the different diagnostic tests and their impact on physician decision making through prospective cohort studies.

### **LIMITATIONS**

Clinical vignette-based surveys have been used for over 30 years to evaluate variability in physicians' approaches to medical decision making and care. It

has been shown that vignette-based surveys produce better measures of quality of care than medical record reviews when used to evaluate differential diagnoses, test selection, and treatment decisions.<sup>15</sup> There is, however, a growing body of evidence on the efficacy of survey methodologies and their potential for erroneous findings.<sup>16,17</sup> This literature focuses on survey error related to target population, sample frame and sampling error, and nonresponse error.<sup>18–21</sup> The self-selecting nature of a Web-based survey undoubtedly results in sampling errors owing to our unknown population denominator and sample representativeness and an inability to estimate a nonresponse rate. We are unable to estimate the probability a given physician would be included in the sample, and as a result of this and other methodological limitations, the extent to which our findings can be generalized is difficult to assess.

Significant practice variability appears to exist among participants who are trained in pediatric emergency medicine. General emergency physicians were not included owing to their low numbers, and it remains undetermined whether they practice differently than study participants. Our study sample included a wide range in the number of years since graduation and number of years in practice. Although not every possible scenario was presented, we developed the vignettes in an attempt to fully represent what defines a febrile seizure as complex according to the AAP guidelines. It should be kept in mind that different patient ages within these categories may play a role in decision making in a given situation.

## CONCLUSIONS

This study indicates that extensive variability exists in the ED approach to patients with CFS. Our findings suggest that optimal management for CFS remains unclear and support the potential benefit of future prospective studies on this subject.

**Competing interests:** None declared.

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