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The semiology of febrile seizures: Focal features are frequent

Michihiko Takasu [a], Tetsuo Kubota [b], Takeshi Tsuji [c], Hirokazu Kurahashi [a], Shingo Numoto [a], Kazuyoshi Watanabe [d], Akihisa Okumura [a,*]

[a] Department of Pediatrics, Aichi Medical University, Japan
[b] Department of Pediatrics, Anjo Kosei Hospital, Japan
[c] Department of Pediatrics, Okazaki City Hospital, Japan
[d] Department of Pediatrics, Nagoya University Graduate School of Medicine, Japan

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ABSTRACT

Objective: To clarify the semiology of febrile seizures (FS) and to determine the frequency of FS with symptoms suggestive of focal onset.
Methods: FS symptoms in children were reported within 24 h of seizure onset by the parents using a structured questionnaire consisting principally of closed-ended questions. We focused on events at seizure commencement, including changes in behavior and facial expression, and ocular and oral symptoms. We also investigated the autonomic and motor symptoms developing during seizures. The presence or absence of focal and limbic features was determined for each patient. The associations of certain focal and limbic features with patient characteristics were assessed.
Results: Information was obtained on FS in 106 children. Various events were recorded at seizure commencement. Behavioral changes were observed in 35 children, changes in facial expression in 53, ocular symptoms in 78, and oral symptoms in 90. In terms of events during seizures, autonomic symptoms were recognized in 78, and convulsive motor symptoms were recognized in 68 children. Focal features were evident in 81 children; 38 children had two or more such features. Limbic features were observed in 44 children, 9 of whom had two or more such features. There was no significant relationship between any patient characteristic and the numbers of focal or limbic features.
Significance: The semiology of FS varied widely among children, and symptoms suggestive of focal onset were frequent. FS of focal onset may be more common than is generally thought.

1. Introduction

Seizure semiology is the most effective way to identify the type of seizure experienced by patients with epilepsy. It has been intensively studied in such patients, especially those with focal epilepsies, which may be susceptible to surgical treatment. Some specific semiological features can be used to identify the location of seizure onset. Tonic movement without impaired consciousness suggests an origin in the primary motor cortex or the supplementary sensorimotor area of the contralateral hemisphere, and a visual aura suggests an origin in the primary visual cortex. In contrast, there have been few studies on the semiology of febrile seizures (FS) [1], FS are the most common seizure disorders in children.

FS have been classified into simple and complex seizures. Most FS are usually considered to be generalized tonic–clonic seizures of short duration occurring only once during a single episode of febrile illness. Complex FS are usually defined as FS with one or more of the following features; focal onset, duration >10 min, or multiple seizures during a single episode of illness. Of these features, the presence or absence of focal features is not easy to determine. Indeed, the definitions are ambiguous, and subtle focal features can easily be missed by observers (such as parents) who are surprised and frightened when a child suffers a seizure. Additionally, several ictal electroencephalographic studies (ictal EEGs) of epileptic seizures have shown that generalized features are not uncommon during focal seizures in infants and younger children [2–4]. Diffuse tonic postures are common during focal seizures (even symmetric seizures) in infants. Therefore, focal seizures in infants and young children can be mistaken for generalized seizures.

Neville and Gindner recently suggested that most FS, especially those that originate in the mesial temporal lobe, may be of focal origin [1]. The cited authors prospectively studied 10 consecutive children with FS. Detailed seizure histories were taken, focusing on phenomena evident before the motor events. A clear preliminary phase, or aura, compatible with a seizure origin in the temporal lobe, was evident in

* Corresponding author at: Department of Pediatrics, Aichi Medical University, 1-1 Yazako Karimata, Nagakute, Aichi 480-1195, Japan.
E-mail address: okumura.akihisa.479@mail.aichi-med-u.ac.jp (A. Okumura).

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seven children. Hamelin and Vercueil reported ictal videotape-recorded EEG findings during an example of "simple" FS of focal onset [5]. The patient opened his eyes and began to cry in association with the development of rhythmic activity in the right centrotemporal region. The cited authors considered the possibility that even simple FS may be focal (possibly hippocampal) in nature.

Thus, we hypothesized that FS of focal onset may be more frequent than presently thought. We therefore prospectively surveyed FS semiology focusing on manifestations at seizure commencement. Our aim was to clarify the semiology of FS and to determine the frequency of FS with symptoms suggestive of focal onset.

2. Patients and methods

This prospective study was performed from May 2014 to October 2015 in the Departments of Pediatrics of Aichi Medical University Hospital, Anjo Kosei Hospital, and Okazaki City Hospital. Children with FS who visited these hospitals immediately after their seizures were consecutively included. FS were defined as seizures in children aged 6 months to 5 years associated with a fever > 38.0 °C and without central nervous system infection or acute metabolic derangement. Children with any previous evidence of neurological or developmental abnormalities were excluded. The study was approved by the ethics committee of Aichi Medical University Hospital.

Manifestations of FS were described by the parents using a structured questionnaire as soon as possible after arrival at the hospital (at the latest, within 24 h). The questionnaire consisted principally of closed-ended questions. The parents or caregivers were allowed to choose two or more answers for each question and to add whatever comments they wished. The attending pediatricians assisted the parents if necessary. Seizure duration was numerically recorded. We focused on events at seizure commencement, including changes in behavior and facial expression, and ocular and oral symptoms. Changes in facial expression were evaluated using a facial action coding system [6]. We showed parents pictures of various facial expressions: disgust, fear, anger, contempt, sadness, surprise, and happiness. Parents were asked to choose the picture that was most similar to the child's facial expression at seizure onset. We also asked whether the child was awake or asleep before seizure onset, and documented the autonomic and motor symptoms during seizure and responsiveness after seizure.

We explored the focal and limbic features of all patients. Focal features were defined as seizure symptoms that were presumed to arise from specific brain regions. The following items were classified as focal features:

1) Any change in behavior;
2) Changes in facial expression: fear, sadness, anger, or laughter;
3) Ocular symptoms: lateral deviation or eyelid flutter;
4) Oral symptoms: at least one of the following: drooling, oral automatism, cheek twitching, or mouth deviation;
5) Events during a seizure: both specific autonomic symptoms (at least one of the following: pallor, cyanosis, or vomiting) and nonconvulsive motor symptoms (atonicity or no obvious movement) were evaluated.

Limbic features were defined as seizure symptoms that were very likely of mesial temporal onset. The following items were classified as limbic features:

1) Changes in behavior: crying or screaming;
2) Changes in facial expression: fear or sadness;
3) Oral symptoms: oral automatism.

No ocular, autonomic, or motor symptom was considered to be a limbic feature. The numbers of focal and limbic features were counted for each patient.

The rates of events at the commencement of FS and those during FS were compared according to the presence or absence of past history of FS, because observation of a first FS could be more emotionally challenged and less reliable than that of a second or later FS. We also performed statistical analyses comparing differences in patient characteristics according to frequency of non-specific focal and limbic features. We used the chi-square and the Kruskal–Wallis tests to compare categorical and numerical variables, respectively. A P-value <0.05 was considered to reflect statistical significance. All statistical analyses were performed with the aid of EZR ver. 1.33 software (available at http://www.jichi.ac.jp/saitama-sct/SaitamaHP.files/statmed.html) [7].

3. Results

We obtained data about 106 children (60 boys and 46 girls) with FS. The median patient age was 24 months (range, 8–71 months). Forty-one children (39%) had histories of FS. Nineteen children (18%) had experienced two or more episodes of FS. Family histories of FS (in parents and siblings) were recorded for 39 children (37%). Seizure duration was <1 min in 10 children (9%), 1–4 min in 60 (57%), 5–9 min in 16 (15%), 10–19 min in 11 (10%), ≥20 min in 3 (3%), and undetermined in 6 (6%). Before seizures, 63 children (59%) were awake, and 43 (41%) were asleep. After seizures, 28 children (26%) were alert, 45 (42%) were drowsy, and 33 (31%) fell asleep.

Table 1 summarizes events at the commencement of FS. Behavioral changes were observed in 35 children (32%). Nineteen 19 (18%) cried or screamed; 10 (9%) were poorly responsive (9%); and 4 exhibited motion arrest (4%). One child developed motion arrest followed by crying,

Table 1
Events at the commencement of febrile seizure.

	All (N = 106)	No past history of FS (N = 65)	With past history of FS (N = 41)	
Change in behavior				
Cry or scream	19 (18%)	13 (20%)	6 (15%)	NS
Poor responsiveness	10 (9%)	6 (9%)	4 (10%)	NS
Motion arrest	4 (4%)	3 (5%)	1	NS
Rough breathing	2 (2%)	0	2 (5%)	NS
Irritability	1 (1%)	1 (2%)	0	NS
Complaint of pain	1 (1%)	1 (2%)	0	NS
Unremarkable	71 (67%)	43 (66%)	28 (68%)	NS
Change in facial expression				
Surprise	24 (23%)	15 (23%)	9 (22%)	NS
Fear	19 (18%)	13 (20%)	6 (15%)	NS
Sadness	6 (6%)	4 (6%)	2 (5%)	NS
Disgust	1 (1%)	0	1 (2%)	NS
Anger	1 (1%)	1 (2%)	0	NS
Laugh	1 (1%)	1 (2%)	0	NS
Contempt	1 (1%)	0	1 (2%)	NS
Blank face	27 (26%)	16 (25%)	11 (27%)	NS
Unremarkable	36 (33%)	25 (38%)	11 (27%)	NS
Ocular symptoms				
Upgaze	38 (36%)	24 (37%)	14 (34%)	NS
Staring	32 (30%)	19 (29%)	13 (32%)	NS
Blank eyes	21 (20%)	15 (23%)	6 (15%)	NS
Lateral deviation	8 (8%)	3 (5%)	5 (13%)	NS
Crossed eyes	4 (4%)	2 (3%)	2 (5%)	NS
Eyelid flutter	3 (3%)	2 (3%)	1 (2%)	NS
Multidirectional movement	2 (2%)	1 (2%)	1 (2%)	NS
Unremarkable	18 (17%)	13 (20%)	5 (12%)	NS
Oral symptoms				
Open slightly	37 (35%)	25 (38%)	12 (29%)	NS
Drooling	30 (28%)	16 (25%)	14 (34%)	NS
Clenching teeth	21 (20%)	10 (15%)	11 (27%)	NS
Oral automatism	15 (14%)	8 (12%)	7 (14%)	NS
Open widely	10 (9%)	6 (9%)	4 (10%)	NS
Cheek twitching	6 (6%)	5 (8%)	1 (2%)	NS
Mouth deviation	3 (3%)	1 (2%)	2 (5%)	NS
Unremarkable	16 (15%)	13 (20%)	3 (7%)	NS

NS: not significant.