ORIGINAL ARTICLE

Retinal changes in febrile seizures in children: a retrospective analysis in Tuzla Canton, Bosnia and Herzegovina

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ABSTRACT

Aim To evaluate the possibility of retinal haemorrhages or any other retinal pathology caused by febrile seizures alone in children aged between 2 months and 15 years.

Methods Children aged between 2 months and 15 years admitted to the hospital following seizures were examined within 48 hours of admission. The seizures were classified by a paediatric neurologist and a detailed ocular examination, including indirect ophthalmoscopy, was performed by an ophthalmologist.

Results In the period between May 2019 and May 2020 a total number of 106 children were examined. There were 66 (62.3%) male and 40 (37.7%) female children. The youngest patient was 2 months old and the oldest patient was 15 years old. None of the children was found to have retinal haemorrhages or any other retinal pathology.

Conclusion Retinal haemorrhages or any other acute retinal findings in children with febrile seizures are very rare, but we cannot rule out its occurrence. The finding of retinal haemorrhages in a child admitted with a history of seizure should trigger a detailed search for other causes of those haemorrhages, especially shaken baby syndrome. Due to the lack of any manifestations on the retina after febrile seizure, maybe it is time that the current protocol and guidelines, considering obligatory fundus examination, should be re-examined.

Key words: convulsions, fundus haemorrhage, ophthalmoscopy, retinal pathology

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Original submission:
02 March 2021;
Revised submission:
04 May 2021;
Accepted:
21 May 2021
doi: 10.17392/1366-21

Med Glas (Zenica) 2021; 18(2):427-431

INTRODUCTION

A febrile seizure (FS) is a seizure occurring in childhood, after one month of age-associated with a febrile illness and not caused by an infection of the central nervous system (1). They are the most common neurologic disorder, and are seen in 2-5% of children under the age of five in Western Europe and the United States, and even more often, up to 10% in Japanese and Indian children (2,3). The etiology of FS is multifactorial, with genetic predisposition and viral illness as the most common factors (4). Many studies have investigated the seasonal distribution of FS and agreed that winter is the peak season for the onset of FS, but some studies found an increased number of FS also during the summer (5,6). The FS is the most common reason for admission to the paediatric emergency department (7). Clinical evaluation of a child with FS includes a full paediatric examination and detailed neurological examination and should focus on identifying the infection causing the fever (8). Paediatric literature recommends ocular examination of a child with seizures to look for papilledema, retinal haemorrhages, chorioretinitis, retinal coloboma, macular changes, as well as retinal phacomas to guide a paediatrician on possible underlying systemic condition (9).

It is also recommended that an ocular fundus examination should be performed to look for signs of increased intracranial pressure (ICP) (10). The ICP does not cause retinal haemorrhages (RH) in children except haemorrhages associated with papilledema (11-13). If RH are found they can be due to an injury, a variety of systemic diseases (14,15), vomiting or coughing, and after resuscitation. The likelihood of developing RH after seizures is less than 1% with a low prevalence (16). However, in recent guidelines for febrile seizures, there are no recommendations for mandatory ocular fundus examination (17,18).

In Bosnia and Herzegovina, the frequency of retinal haemorrhage or any fundus abnormalities in children with febrile seizures is not well established.

The aim of this study was to establish the frequency of retinal haemorrhages or any pathological findings on the retina after febrile seizures in children aged between 2 months and 15 years in the University Clinical Centre Tuzla.

PATIENTS AND METHODS

Patients and study design

Tuzla Canton is an administrative unit of the Federation of Bosnia and Herzegovina, in the Northeast part of Bosnia and Herzegovina. It is composed of 13 municipalities with the population of 445.028 inhabitants (18). The administrative centre is Tuzla.

A retrospective cross-sectional observational study was conducted with an analysis of the medical records of all children aged between 2 months and 15 years presenting to the Clinic for Children's Diseases, Emergency Department of the University Clinical Centre (UCC) Tuzla with a diagnosis of FS between May 2019 and May 2020. Children with a history of trauma, suspected child abuse or cardiopulmonary resuscitation were excluded. Children who were hospitalized due to febrile seizures but live outside of Tuzla Canton and children who were screened for retinopathy of prematurity and had the active disease were also excluded from the study.

An approval from the Ethics Committee Board of the University Clinic Centre Tuzla was obtained to conduct this study.

Methods

Demographic data, age at presentation, developmental history (developmental milestones appropriate for the age reached on time), past medical and family history regarding allergies, intracranial infections, high fevers, previous seizures, head injuries, family history of febrile seizures, and season when FS occurred were recorded. All patients were examined by a paediatric neurologist who conducted detailed physical and neurological examinations and classified seizures. Only children with febrile seizures without evidence of intracranial infection or history of nonfebrile seizures were included in this study.

According to the age, the patients were divided into the following groups: 2-6 months, 6-12 months, 1-3 years, 3-5 years, 5-10 years, and children 10-15 years old. It was noted if the child required cardiopulmonary resuscitation. Previous eye examinations before the admission for FS were noted as well. The policy of the Children's Hospital (UCC Tuzla) is to perform the manda-

tory fundus examination on all seizing children as a part of the routine physical examination. Ocular fundus was examined by an ophthalmologist with indirect ophthalmoscopy, without indentation, within 48 hours of the patient's admission to the Hospital. The pupils were dilated with tropicamide 0.5% eye drops before the examination. The examination was done by indirect ophthalmoscope (Heine, Gilching, Germany) and using a 20D Volk lens. Findings on fundus were in detail written down in patient's records.

Statistical analysis

Relevant data were presented as frequencies, means, and standard deviation (SD). Statistical analysis was undertaken using Hanley's rule of three (19,20). If none of the "n" patients showed the event in question, the chance of this event (with 95% confidence limit; 0/n) is at most 3 in n (that is 3/n).

RESULTS

In the period from May 2019 till May 2020, a total of 106 children were examined. There were 66 (62.3%) male and 40 (37.7%) female children. The youngest patient was 2 months old and the oldest patient was 15 years old. Most patients were in the age group 1-3 years (49.1%) (Table 1).

Table 1. Gender and age groups of the examined children with febrile seizure (FS) and seasonal variations

Characteristic	No (%) of children
Gender	
Male	66 (62.3)
Female	40 (37.7)
Age	
2-6 months	7 (6.6)
6-12 months	9 (8.5)
1-3 years	52 (49.1)
3-5 years	13 (12.2)
5-10 years	20 (18.9)
10-15 years	5 (4.7)
Season	
Spring	22 (20.8)
Summer	18 (16.9)
Autumn	27 (25.5)
Winter	39 (36.8)

There were 95 (89.6%) children born on time and 11 children (10.4%) were preterm babies. A positive family history of FS in first-degree relatives was found in seven (6.6%) cases. Children with FS were admitted to UCC Tuzla from all 13 municipalities of Tuzla Canton. Most of the children with FS were from Tuzla city, 33 (31.1%) (Figure 1).

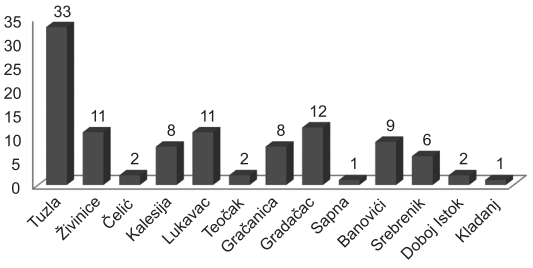

Figure 1. Geographic distribution of children with febrile seizures in Tuzla Canton per 13 municipalities

Febrile seizures occurred throughout the year, but the largest number of children with FS was recorded in the winter and autumn, 39 (36.8%) and 27 (25.5%), respectively (Table 1).

No retinal haemorrhages were found in any of the children. Using Hanley's rule of three, with an upper limit of 95%, the chance of retinal haemorrhages occurring as a result of FS alone was at the most 3 in 100 (2.8%).

We found one child with subatrophic optic disc (diagnosed before FS), while nine children had fundus examination described as pale optic disc without signs of subatrophy or atrophy, or any other retinal changes.

None of the children with FS required cardiopulmonary resuscitation.

Out of the total number, six (5.66%) children had an eye examination before FS due to eye deviation, of which esotropia was found in five children, while exophoria was found in only one child.

DISCUSSION

In our study, FS was more often present in boys and the age group 1-3 years, similar to the reports of other studies (1,21,22). Seasonal variations are known as well, with most cases occurring during winter, as we have found in our study (5,23,24).

Current paediatric guidelines recommend that ocular fundus examination should be performed to look for increased intracranial pressure (ICP) for every child admitted with FS (1). Increased ICP is a theory frequently proffered in legal settings as an alternative cause of severe RHs (12). Unlike neonatal RH, that are benign and are related to birth trauma, that one found from infancy later in life can be a sign of injury and variety of ocular or systemic diseases (14). One of the mechanisms that can also result in RH is a sudden rise in intrathoracic pressure (Valsava type manoeuver) that can happen during seizures (26).

The prevalence of retinal haemorrhage after seizures is still unclear, and there are only a few studies available in the literature (15,25,26). In our study, none of the 106 children were found to have retinal haemorrhages or any other acute retinal finding within 48 hours of their admission following FS. In a similar study done by Sandramouli et al. on 32 children (aged 4 months to 14 years) with seizures, none developed retinal haemorrhage (25). Tyagi et al. in a study on 32 infants with FS, found no cases of retinal haemorrhage (26). Our study included 106 children with a wider age group, and have found no retinal haemorrhage or any other retinal changes in children with FS. The likelihood to find some retinal changes in our study is 0.0283 (less than 3/100). In a study on 153 children aged 2-24 months with FS Mei Zahav et al. found unilateral retinal haemorrhages in only one 8-month-old girl, with the prevalence of retinal haemorrhage secondary to seizures of 0.0065 (15). In two studies (25, 26) from the same Institution the upper limit of 95% confidence interval of retinal haemorrhages following seizures in children under the age of 14 years was less than 5/100, which is insignificantly higher than our finding. In a similar study on 34 children aged 3 months to 9 years, Guo et al. found prevalence of retinal haemorrhages in children with FS lower than 10% (27). The limitation of all these studies is a relatively small number of children in the study group.

A statistical analysis of our study, which included larger study group, showed that in children aged 2 months to 15 years seizures alone were unlikely a cause of retinal haemorrhages or any other acute retinal findings, although the possibility cannot be completely ruled out.

The study conducted in 2008 in Tuzla Canton, Bosnia and Herzegovina, examined clinical characteristics at onset of the first FS, but authors have not analysed the connection between retinal findings and febrile seizures (28). Taking into consideration that until the present day, the available studies show none, except one case, of the retinal haemorrhage associated with the febrile seizure, we recommend that the current protocol and guidelines be re-examined in children with FS.

In conclusion, retinal haemorrhages or any other acute retinal findings in children with febrile seizures are very rare, our study found none, but we cannot rule out its occurrence. Finding a retinal haemorrhage in a child after a febrile seizure episode should therefore trigger an extensive search for other causes, such as non-accidental injuries including child abuse. Due to the lack of any manifestations on the retina after FS, maybe it is time that current protocol and guidelines be re-examined.

FUNDING

No specific funding was received for this study.

TRANSPARENCY DECLARATION

Conflict of interest: None to declare.

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