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# Febrile convulsion in Libyan children

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**Abstract:** Febrile convulsions have been defined as any convulsion associated with a fever of more than 38$^{o}$C without central nervous system infection in a child aged six months to five years. Febrile convulsions can be divided into two groups simple and complex seizures. This study aimed to determine the prevalence of febrile convulsions in Libyan children and to investigate the associated risk factors related to this type of seizure in children. 120 cases of febrile convulsions with one day - 12 years old were collected from April to August 2022. A study was conducted in the Pediatrics Hospital in Bayda City, Libya about the prevalence of febrile convulsions in children, the data collection tool was a self-designed pre-tested validated questionnaire including general information such as age, gender, family history, and admission to the hospital. In addition, data such as body temperature, recurrent convulsion attacks, the condition of hospital admission, discharge status, and the treatment in-hospital and out-hospital. The collected data were analyzed by using descriptive methods. Among the 120 children, the majority of the cases were aged between two years and five years old. The gender prevalence rate in this study was 55.0% in males and 97 of the children were hospitalized due to simple febrile seizure (80.8%), 92 of the cases with no family history of febrile convulsions (75.0%) and respiratory tract infections were the main cause of febrile convulsions. In conclusion, this study indicated that respiratory tract infections are the most common cause of febrile convulsions among Libyan children, however, a large sample study is needed to support this issue in Libya.

## Introduction

Febrile seizures or convulsions (FCs) are seizures that happen in young children [1]. FCs are the most commonly occurring epilepsy syndrome experienced in infants or children between six months to six years with an incidence of less than 04.0% [2]. FCs describe any seizure that occurs in response to a febrile stimulus without meningitis, encephalitis, serum electrolyte imbalance and other acute neurologic illnesses. Several studies on molecular genetics and pathogenesis of the FCs have been reported. Thus, it has been recognized that there is a significant genetic component for the susceptibility of FCs with different described mutations. Others have tried to correlate FCs to immunologic problems through interleukin, cytokines, immune globulin and interferon [1]. FCs present the most common issue in pediatric neurology. This changed with time. In 1949, Lennox described FC may cause brain pathology as evidenced by transient or permanent neurological deficit [1, 2]. In difference, in 1991, Robinson [3] referred to children with FCs as having an excellent

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prognosis. There is a change in opinion due to reason, one reason is that earlier studies of the relatively poor prognosis of children with more severe problems attending specialized clinics or hospitals were balanced by more optimistic findings of population-based studies of less selected groups of children [4-6]. Another reason is that the results of studies depend on the way FC is defined - some investigators have included children with underlying meningitis or encephalitis in their studies of FCs [7-9].

It is now recognized that in a small number of children, FCs are the first sign that the child has an inherited seizure disorder that includes as FC is an event in infancy or childhood, usually occurring between three months and five years of age, associated with fever but without evidence of the intracranial infection or defined cause. This excludes seizures with fever in children who have had a prior of FCs. The American Academy of Pediatrics [10] reported clinical practice guidelines defining an FC as a seizure accompanied by fever (temperature ≥38°C), without central nervous system infection that occurs in infants and children six through 60 months of age. FCs are further classified as simple or complex and the most common type of seizures observed in pediatrics. Additionally, FC is a long-term management of children with fever-associated seizures [10]. Does not exclude children with prior neurological impairment and neither provides a specific temperature criteria nor defines a seizure. Another definition from the International League Against Epilepsy [11] is reported. Thus, FCs are seizures that occur in childhood after one month of age associated with a febrile illness not caused by an infection of the central nervous system. It is without previous neonatal seizures or a previous unprovoked seizure and it does not meet the criteria for other acute symptomatic seizures [12, 13]. This type of seizure represents a unique response of a child's brain to fever especially on the first day [14]. However, children represented with seizures in association with illness, particularly gastroenteritis, fever was not present at the time of presentation. Even though, their prognosis become normal, the risk of having subsequent epilepsy is higher than those with FCs [15, 16]. Approximately 3.0%-5.0% of children between the ages of six months and six years will have FCs, most seizures are less than five minutes in duration and the child is completely back to normal within one hour of the event. During FCs, the body becomes stiff, and arms and legs will begin twitching. Irregular breathing, losing consciousness with alert eyes and skin may look a little bit darker. The child may return quickly to normal activity because it usually lasts for a few seconds, but there is a specific rare condition including that the seizure lasts for 15 minutes [17]. However, 2.0%-7.0% of the FC cases develop accompanied by epilepsy and the risk increases by the presence of complicated FCs [16]. A previously published study has shown that there is no increase in the risk or incidence of mortality in children with FCs [18]. Recurrence frequency is 10.0% in patients with no risk factors 25%-50% in the presence of few risk factors; 50%-100% in the presence of more risk factors [18]. The risk of epilepsy is estimated at around 01.5% in patients with simple FC [20] while the risk of epilepsy in patients with complex febrile convulsion (CFS) is estimated between four and 15.0% [20]. Little is known about the incidence or prevalence of FCs in Libya, therefore, this study aimed to determine the prevalence of FCs in Libyan children and to investigate some associated risk factors related to this type of seizure in children.

## Materials and methods

An analytical cross-sectional study was carried out from April to August 2022 in Bayada, Libya. A total of 120 Libyan children from one day old to 12 years old visiting the Bayda Medical Center were included in this study by a systematic random sampling technique. Medical data of participants were collected using a structured self-designed questionnaire. The questionnaire was validated by the staff members of the Faculty of Pharmacy, Omar Mukhtar University. It is established to determine the prevalence of FCs in children in Bayda and to determine the associated risk factors related to FCs.

The collecting data included the following criteria age, gender, family history, body temperature, convulsions of the child, type of FCs, number of attacks, diagnosis, the time of recurrent, symptoms, treatment and

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admission status. The date of entry and discharge, the condition of admission to the hospital, and the treatment in the hospital and outside have also been recorded. Excluded criteria were children who deteriorate from FCs to epilepsy. The study was conducted after having approval from Bayda Medical Center and the Faculty of Pharmacy, Omar Mukhtar University and approval (informed consent) was having from the parents of the participants.

*Data presentation:* An analysis of the data was carried out by using SPSS version 17. A descriptive presentation of the data by standard deviation, range and percentage have been used for all the variables.

## Results

*Age and prevalence of febrile convulsions:* In **Table 1**, 1.7% of the cases were more than eight years, 13.3% of the cases from five years to eight years and 39.2% of the cases from one day to two years old. A large proportion of them were between the ages of two years to five years old 45.8%. Regarding gender, the number of male subjects in this study was 66 which represented 55.0%, while the female subjects were 54 which represented 45.0% of the total sample. The ratio of male to female between the subjects was small.

In this study, there were 28 of the cases out of 120 (23.3%) have a family history of FCs while the majority of the cases reported no history of parents, brothers and sisters as shown in **Figure 1**. Further, in **Table 2**, the distribution of the cases with the type of seizures is shown. Thus, 80.8% of the total sample suffered from simple FCs while 19.2% from complex FCs. In **Figure 2**, the distribution of the cases according to the body temperature of children with FCs is shown. Almost in all the cases, the average of body temperature was between 37°C and 40°C with some cases of normal body temperature and some with more than 40°C (15.0%).

**Table 1:** Age and prevalence of febrile convulsions in Libyan children

| Age | Frequency | Percentage | Valid Percent |
|---|---|---|---|
| 1 day - 2 years | 47 | 39.2 | 39.2 |
| 2 - 5 yreas | 55 | 45.8 | 45.8 |
| 5 - 8 years | 16 | 13.3 | 13.3 |
| > 8 years | 2 | 1.7 | 1.7 |
| **Total** | 120 | 100.0 | 100.0 |

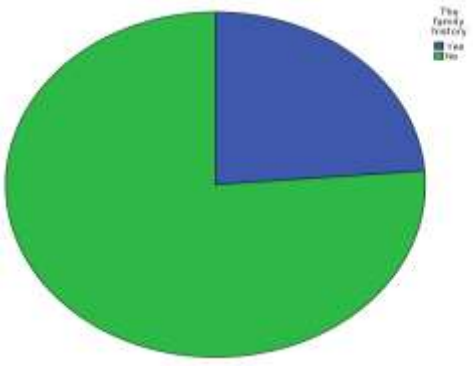

**Figure 1**: Distribution of Libyan children according to family history

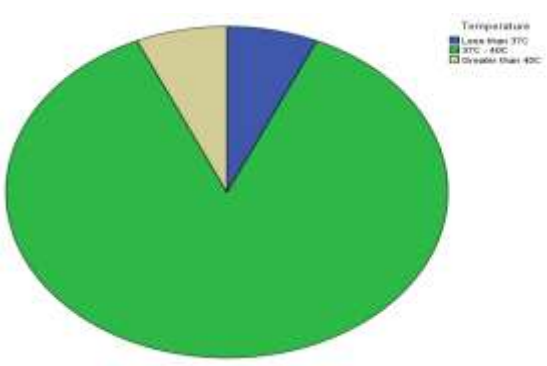

**Figure 2:** Distribution of the cases according to the body temperature of children with FCs

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**Table 2**: Libyan children with attack of simple or complex seizures

| Seizures | Frequency | Percentage |
|---|---|---|
| Simple | 97 | 80.8 |
| Complex | 23 | 19.2 |
| **Total** | 120 | 100.0 |

In **Table 3**, the frequency of attack of FCs among the participating children is shown. The most common group of children with one attack revealed that 70 out of 120 children have one attack followed by 34 children with two attacks, 10 patients with more than two attacks. Only six children with the complex number of attacks. **Figure 3** shows diagnosis of the Libyan children with FCs. Almost one-third of the cases were diagnosed with fever and general convulsions while the other third was diagnosed with convulsions, eve rolling, fourth secretion and fever. The other was diagnosed with convulsions, ear infection, diarrhea, tonsillitis and pneumonia. Few cases were diagnosed with convulsions, an increase in brain electricity and hypoglycemia.

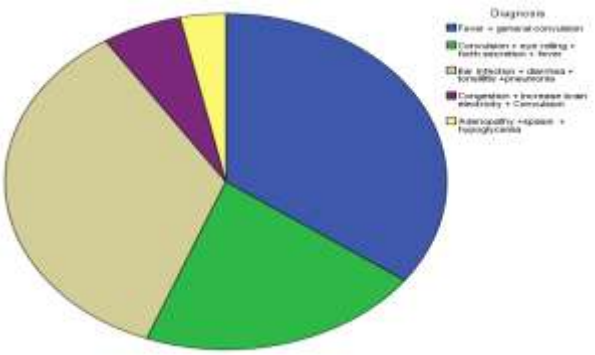

**Figure 3:** Diagnosis of the Libyan children with febrile convulsions

**Table 3**: Frequency of febrile convulsion attack in Libyan children

| Number of attacks | Frequency | Percentage |
|---|---|---|
| 1 Attack | 70 | 58.3 |
| 2 attacks | 34 | 28.3 |
| > 2 attacks | 10 | 8.3 |
| Complex | 6 | 5.0 |
| **Total** | **120** | **100.0** |

In **Figure 4**, different causes that lead to admission to the hospital with FCs are shown. Thus, respiratory tract infections accounted for more than half of the admissions (53.3%), followed by an almost equal ratio of pneumonia, acute gastrointestinal disturbances, urinary tract infections, abscesses and meningitis. The lowest cause for hospital admission of the children with FCs was urinary tract infections (6.7%).

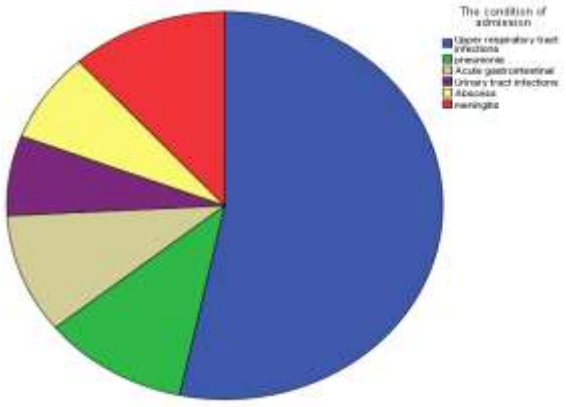

**Figure 4:** Conditions of hospital admission of children with febrile convulsions

In this study, 96 children with FCs were discharged from the hospital after completing the course of treatment in good condition (80.0%). 21 children were discharged under the responsibility of their parents (17.5%) while three children died (2.5%).

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**Table 4:** Distribution of treatment among the Libyan children

| Drug treatment | Frequency | Percent | Valid Percent |
|---|---|---|---|
| Antipyretic | 04 | 03.3 | 03.3 |
| Diazepam | 07 | 05.8 | 05.8 |
| Antibiotic | 08 | 06.7 | 06.7 |
| Antipyretic & antibiotic | 20 | 16.7 | 16.7 |
| Antipyretic, antibiotics & Diazepam | 36 | 30.0 | 30.0 |
| Antipyretic & diazepam | 03 | 02.5 | 2.5 |
| Antibiotics & diazepam | 05 | 04.2 | 4.2 |
| Antibiotics & salbutamol | 01 | 0.8 | 0.8 |
| Antibiotics, salbutamol & vitamin D | 01 | 0.8 | 0.8 |
| Salbutamol | 02 | 01.7 | 01.7 |
| Antipyretic & normal saline | 10 | 08.3 | 08.3 |
| Anticonvulsant | 12 | 10.0 | 10.0 |
| Others | 11 | 90.2 | 09.2 |
| **Total** | **120** | **100.0** | **100.0** |

In **Table 4**, the distribution of the treatment of children with FCs by individual drugs is shown. Thus, most of the cases (n=36) were under antipyretics, antibiotics and diazepam (30.0%), with 20 cases from the total sample under antipyretics and antibiotics (16.7%). 12 cases were under anticonvulsants, and 10 children were given antipyretic with normal saline. The other cases were distributed with several different drugs such as antipyretics only, diazepam only, antibiotic only or salbutamol only as an adjunctive treatment. The distribution of the treatment in detail which was administered to the children (inpatient) is shown in **Table 4**.

## Discussion

The prevalence of FCs in Beyda was increased and age influences on this approach to convulsion disorders. The highest prevalence was reported among 2-5 years old which was about half of the cases. On the other hand, the lowest prevalence was in a group of 8-12 years old. It has previously been reported that the height peak occurs at 1-2 years old and low below six months or after three years of age [7, 11, 21]. Generally, FCs decrease after four years of age and rarely occur in children more than seven years [22]. Although in another study, long-term mortality study, is not increased in children with FCs, there were three death cases in this study, and it seems to be a small excess mortality at the age of two years after a complex seizure. Death of FCs is very rare even in high-risk children [23]. Currently, the total number of cases is low but the findings indicated that males are slightly more than females in FCs, however, a larger sample is needed to confirm this ratio. While in a previous report on FC has shown more than two-thirds of cases were male which is also a small size sample study [24].

In the current study, Libyan children with simple seizures were very high and the complex was found in about 20.0%. This is in line with the previous study [25]. Regards to children who are diagnosed clearly with FCs in this study, it was found that there is half of the cases were given antibiotics which indicated that the cause of FCs is infection with bacteria, nevertheless, in other studies children aged between 2 and 24 months old with FCs are at a similar risk for occult bacteremia as those with fever alone [26]. The admission has a deep excite, it is variable of admission, the highest prevalence was respiratory tract infections, then, pneumonia and acute gastrointestinal, meningitis. In another study, it was found the most common cause of fever leading to FCs was respiratory tract infections, the most common being urinary tract and central nervous infections [25]. About the body temperature, the variable of the highest temperature level was between 37°C-40°C which was and the lowest level was between temperatures less than 37°C and greater than 40°C. In a study of 344

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children, the body temperatures were recorded between 38°C-39°C for the majority of children and most of them had not used diazepam. The children with body temperatures between 38°C-39°C were at a higher level, body temperatures below 38°C and between 39°C-40°C were at the next level. Children with body temperature above 40°C were reported at a lower level [27]. Thus, in the current study, fever (increased brain electricity, congestion, hypoglycemia, convulsions and adenopathy) is two-thirds fold while symptoms of hypoglycemia and adenopathy is low which is in line with the previous study [25]. Another diagnosis was made as cerebral palsy (1.8%), tubercular meningitis (1.5%) and hypertensive encephalopathy (1.5%) [27]. Many etiologies including electrolyte imbalance (hypoglycemia and hypocalcaemia), hydrocephalus, neurocutaneous syndrome, intracranial hemorrhage, brain abscess, congenital malformations of the central nervous system, hepatic and enteric encephalopathy accounted for remaining (6.0%) of cases [28]. Data for the mortality rate during the hospital stay is 2.5% and others discharged after completion of treatment 80.0% while the previous study reported that 4.4% of the children died in hospital, 4.0% had left against medical advice and 1.8% were referred to another center and the remaining were discharged after fully successful treatment [28].

Most of the patients that exist in the hospital had been given antipyretics, antibiotics and diazepam and about a third of the children were under antibiotics and antipyretics while 10.0% were under the anti-convulsant. In another study, most of the FCs controlled in the emergency department with medications and sponging, because of the development of serious effects prolonging complex febrile fits such as aspiration, trauma, recurrent fist and progression to epilepsy. About half of the children are controlled by medications alone. Immediate medications that are used include diazepam and non-steroidal anti-inflammatory drugs depending upon symptoms. Others used in almost every patient to treat infection are ceftazidime, efotaxime and ampicillin. In this study of FCs, more than half of the children suffer from one attack with percentage and about a third of children were exposed to two attacks with 05.0% complex and suffering from several attacks. This is comparable to the previous reported study [29] in simple FCs were observed in most children but several attacks that more than two and were complex cases. There is 20.0% of cases have a family history of FCs and the rest without any family history which is in good agreement with the study described those 340 children for whom information on family history was available, 76.1% without a family history [29]. The frequency of the recurrence factor is high, as one recurrent (63.3%) and low in more than four recurrent (08.0%) similar to the study of recurrent FCs [29].

*Conclusion:* The findings concluded that gender has no major role in the attack of febrile convulsions while family history and age play a role. Bacterial infections are respiratory tract infections that is the predominance of febrile convulsions which were based on in and out-prescriptions of antibiotics for most of the febrile convulsion children in Libya.

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**Author contribution:** NSSM conceived, designed the study, collected data and performed the analysis. NAA, NIA & SSM contributed to collecting data and contributing to analysis. All authors drafted, revised the manuscript and approved the final version of the manuscript and agreed to be accountable for its contents.
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**Ethical issues:** Including plagiarism, informed consent, data fabrication or falsification and double publication or submission were completely observed by the authors.
**Data availability statement:** The raw data that support the findings of this article are available from the corresponding author upon reasonable request.
**Author declarations:** The authors confirm that all relevant ethical guidelines have been followed and any necessary IRB and/or ethics committee approvals have been obtained.

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