CLINICAL ASPECTS OF FEBRILE SEIZURES, KNOWLEDGE, ATTITUDE, PRACTICE AND PSYCHOLOGICAL IMPACT ON PARENTS

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A thesis submitted in partial fulfillment for the requirements of the Degree of
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بسم الله الرحمن الرحيم

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Qūūk Žt āyDž

(113 ق.م) تأييداً
Dedication

To

My dear parents …,

My sisters, brothers …

And

To all who love & take care of children …

Aida
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ABSTRACT

Febrile seizures (FS) are a common, world wide benign condition with an excellent prognosis. This cross sectional hospital based case control study was conducted in the period between March 2004 till June the same year in 3 major paediatric emergency hospitals, aiming to discover some facts about FS in our community.

116 children with FS were enrolled in the study who were aged matched to four controls to determine risk factors for a first FS. The mean (±S.D) age of children under the study was 22.4± 14.3 months. 63 (54.3%) of the children were aged 18 months and below, mean (±S.D) age of onset of seizures was 16.1 ± 9.6 months. Male to female ration was 1.5 : 1.

70 children (60.3%) of FS were simple seizures while 46 children (39.7%) were complex. In children with recurrent FS, 25 had complex seizures representing 54.3% of total children with complex seizures and 17 children had a simple seizure.

Risk factors for a first FS were found to be highest with parental perception of slow development (OR : 11.59), family history of FS in a second – degree relative (OR : 7.20) then family history of FS in a first-degree relative (OR : 4.04). International studies have found family history in first-degree relatives, neonatal discharge after 28 days and family history of FS in second-degree relatives to be important risk factors.
47.2% of children with recurrent FS had their first attack of seizure before one year of age, and 19% of them had a positive family history in a first degree relative. 97% of the parents knew fever can cause convulsions. 6.9% related the cause directly to evil eye and another 6.9% to witch craft. 33.6% of parents considered FS as a type of epilepsy. 26.7% of the parents recognized aspiration as an acute complication of seizure. Injuries (19.8%) and cardiac arrest (2.6%) were recognized to a lesser degree.

Further investigations after an attack of FS were requested by 32.8% and 49.1% requested further neurological follow-up. 28.5% considered anticonvulsants a corner-stone of management and 4.3% considered traditional medicine as the only treatment option. Health institutes and personnel (12.9%) and media (9.5%) were weak sources of information. The majority of information (77.6%) were gathered from neighbors and relatives. 62.1% of parents considered an attack of FS a major life-threatening event. Paralysis was expected by 71.6% of parents, while brain damage and mental retardation were expected by 56.9%. Death was expected by 39.7% of parents. Traditional treatment was advocated by 30.2% of parents. First aid to be applied during a seizure was known by few and performed by fewer. Non-recommended or even harmful practices were so prevalent (82%).

Anxiety was severe in more than half of the parents when assessed by the State – Trait Anxiety Inventory and there was no significant correlation between the severity of anxiety and a previous FS attack (P=0.338) or presence of a family history of FS in a first (P=0.687) or a second (P=0.446) degree relatives.
There was an inverse correlation between the score of knowledge and the attained scores on the anxiety scale. 58.6% of the parents had poor knowledge about FS. Parents educational level (P=0.513), family history of FS in first-degree (P=0.575), or second-degree (P=0.563) or a previous attack of FS (P=0.525) had no effect on attaining knowledge about FS.
بحث

ملخص

كحة العالم

انحاء كل في شاعة ظاهرة موية

 Vadot

وحيدة غير وعاقبة وتكون خطرة غير مرشية.

بين ما الفترة في مقارنة حالات للدراسة تموذجة للعينة للدراسة هذة أجرت مارس 2004 لحوارات مشفية ثلاث في العام نفس منه يوينو وحتي م 3

المجتمع في موية محية في النبات الأمشية للفحص وتهدف.

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<td>Cyclo – Oxygenase 1</td>
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<tr>
<td>CSF</td>
<td>Cerebrospinal fluid</td>
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<td>DPT</td>
<td>Diphtheria – Pertusis – Tetanus</td>
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<td>EEG</td>
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<td>FS</td>
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<td>GABRG2</td>
<td>GABA A Receptor Gama 2 subunit</td>
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<td>GEFS +</td>
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<td>Human herps virus type-6</td>
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<td>Interleukin 1 beta</td>
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<td>IQ</td>
<td>Intelligence quotient</td>
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<td>KAP</td>
<td>Knowledge, Attitude and Practice</td>
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<td>LP</td>
<td>Lumbar puncture</td>
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<td>MMR</td>
<td>Measle – Mump – Rubella</td>
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<td>MTS</td>
<td>Mesial Temporal Sclerosis</td>
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<td>PG</td>
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<td>SCN1B</td>
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<td>STAI</td>
<td>State – Trait Anxiety Inventory</td>
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Chapter One
1. INTRODUCTION AND LITERATURE REVIEW

1.1. General consideration and historical notes:

Febrile seizures are the most common and benign convulsive disorder in childhood and a frequently cause of emergency hospital admission \(^{(1)}\). Febrile seizures (FS) are age dependent and are rare before the age of 9 month and after 5 years of age, the peak age of onset is 14-18months\(^{(1)}\). Two to five percent of children experience at least one FS before the age of five in Western Europe and the United States, and six to nine percent of children in Japan \(^{(2)}\).

Seizures were recognized as complications of febrile illnesses from the time of the early Greeks\(^{(3)}\). The strong dependence of FS on age for the expression was noted from Hippocratic writings\(^{(3)}\). Hippocrates observed: Children are likely to have convulsions if the fever is high .... This most commonly appears under the age of seven. As they grow up and reach adult years, they are no longer likely to be attacked by convulsions in the course of a fever.

Since that time it was observed that convulsions were
particularly likely to occur during the eruptions of the canines. Thomas Willis\textsuperscript{(3)} in 1667 stated that: Children are more subject to convulsions within the first or second month after they are born and again about the time of teething.

A relationship between teething and convulsions was sited in 4 of 30 Hippocratic Aphorisms\textsuperscript{(3)}. But then the events were considered to be time associated rather than interdependent.

A positive family history of convulsions in parents was considered an important predisposing factors, Starsmare\textsuperscript{(3)} in 1664 wrote ‘signs of the coming of it in children are because the child is born of parents that have this Falling Sickness’.

Greeks\textsuperscript{(3)} considered FS as a sacred disease. Other predisposing factors are cold phlegms, plumpness and hard bellies, state of nutrition, humours and vapours, adverse perinatal events, influences of air, water and places, meningitis smallpox measles and strait clothes (over heating).

Death, neurological sequelae and later epilepsy was considered the most frequent outcomes of FS from the earliest times. Hippocrate\textsuperscript{(3)} in particular believed that permanent neurological sequelae protected the child from a further seizure attack and that
children who recover completely are more liable for recurrences.

Since then they were considered to be severe and fatal until in the 1970s, when two population based studies\(^4\) formed the current view of FS; that they are: common, many recur, development outcome is not altered and few children later develop epilepsy.

1.2. Definition:

FS is defined as a convulsion that is associated with an elevated temperature, greater than 38°C, occurring in a neurologically healthy child whose age is between 6 months and 6 years. Children whose seizures are attributable to a central nervous system infection or inflammation or acute systemic metabolic abnormalities and those who have had a previous afebrile seizure or central nervous system abnormality were excluded from the diagnosis\(^5\).

1.3 Epidemiology:

FS is a worldwide problem, by 6 years of age 3% to 4% of children have one or more FS\(^6,7\). They are slightly more common in boys and black (4.2%) verses white children (3.5%)\(^6\).

1.4 Etiology and pathogenesis of febrile seizure:

FS occur in young children in a time in development when the
seizure threshold is low. This is a time when young children are susceptible to frequent infections and respond with comparably higher temperature. Investigators have failed to identify a single aetiological agent to cause FS, but have shown a number of factors interacting to bring on a FS$^{(2,4,8-9)}$.

1.4.1. Family history and febrile seizures

One of the important predictors of first FS is a family history of FS in either a first ($P<.001$) or second-degree relative ($P=.02$)$^{(10)}$.

Family history in first-degree relatives demonstrated an increasing risk with the number (one or two) of first-degree of family members who had previously had FS ($P<.001$). This same relationship of increasing risk in more relatives was also seen for second-degree relatives ($P=.004$)$^{(10)}$. It was found that children having their first FS had an odd ratio (OR) of 6.5 for positive family history of FS in first-degree relatives and 3.6 in second or higher degree relatives compared with children with no family history of FS$^{(11)}$. Bethune et al in his case control study to assess risk factors for a first FS found OR of 5.08 and 3.86 for positive family histories of FS in first and second-degree relatives respectively. Furthermore, Bethune reported that a family history of FS was also highly associated with
multiple FS within 24 hours of the initial seizure. Of the ten children with a positive family history in first-degree relatives, five had recurrences, compared with seven of 64 with a negative family history\(^{(10)}\).

### 1.4.2 Genetic factors and febrile seizures:

Genetic factors are clearly important for the occurrence of FS\(^{(2,4,6)}\). Several modes of inheritance for transmission of FS trait have been suggested\(^{(12)}\). Autosomal recessive inheritance is unlikely, as there is an excess of parents affected and the risk to siblings is less than 25%\(^{(6)}\). There is growing evidence that a polygenic or genetically complex mode of inheritance underlines the common FS trait, and only a minority is due to monogenic disease. In some families, it appears to be a dominant rate with incomplete penetrance\(^{(12,13)}\).

FS are likely to be characterized be considerable genetic heterogeneity\(^{(14)}\). Locus heterogeneity has been documented by the identification of several loci associated with FS phenotype\(^{(2)}\). Autosomal dominant loci for familiar FS have been localized to chromosome 8q\(^{(15)}\), 19p\(^{(16)}\), 2q\(^{(17)}\) and 5q\(^{(12,18)}\).

A specific subgroup of the familial FS have been described, the generalized epilepsy and febrile seizure “plus” syndrome.
(GEFS+). The syndrome showed complex inheritance in some families and major autosomal dominant gene inheritance in others \(^{(2,19)}\). In this syndrome, patients express a highly variable phenotype combining FS, generalized seizures often precipitated by a fever at age of 6 years or more and partial seizures with a variable degree of severity. The first GEFS+ susceptibility locus on chromosome 19q and a mutant sodium channel subunit (SCN1B) has been detected \(^{(20,21)}\). Other loci have been found on chromosome 2q \(^{(22-24)}\) where mutations have been identified in sodium channel subunit (SCN2A) gene \(^{(25-27)}\) and in the SCN2A gene \(^{(28)}\).

On chromosome 5 the mutation has been found in GABRG2 gene (GABA (A) receptor gamma 2 subunit) in families with phenotypes closely related to GEFS+ \(^{(29-30)}\).

### 1.4.3 Fever and febrile seizure:

It was frequently taught that rapid rise in temperature is responsible for causing a FS; yet, there is no clinical data to support this hypothesis. Evidence concerning the rate of rise of temperature and height of temperature and their roles in provoking FS were reviewed \(^{(31)}\) and showed that the experiments done were done on animal models and hyperthermia was induced to study the effect of
pyrexia. Thus, the relevance of the hyperthermia model for understanding fever or FS is questionable, because it was on an entirely different mechanism for elevating body temperature and it doesn’t take into account the different responses of the body to hyperthermia versus fever. Furthermore, her review didn’t show any association between rapid rise in temperature and occurrence of FS.

On the other hand, investigations have showed that the height of body temperature was the important determinant in the induction or occurrence of FS \(^{(31,32)}\). Furthermore, children with FS were followed up during subsequent illnesses and data in the height of fever were collected. The mean temperature was higher during episodes associated with FS compared with the maximum temperature observed in episodes in which no seizure occurred \(^{(32,33)}\).

Each additional degree in body temperature above 38.3°C almost doubled the risk of FS \(^{(11)}\).

In a large cohort studying children presenting with FS, 77% of children had an identifiable cause of fever. 38% of them had upper respiratory tract infection or pharyngitis, 23% had otitis media, 15% had pneumonia, 7% had acute gastroenteritis, 5% had roseola infantum, 1.4% had the flu and 12% had other ailments \(^{(6)}\).
It has been suggested that, primary infection with human herpes virus type-6 (HHV-6), the etiologic agent for infant roseola infantum, might be important in the first FS\(^{(34)}\). It's postulated that the viral invasion of the brain or fever causes the initial FS, and that the virus might be reactivated by fever during subsequent illnesses, causing recurrent FS.

These assumptions have not been confirmed in a prospective study. On the other hand, neither children with FS have a higher incidence of HHV-6 infection than age-controls, nor were any differences in FS recurrence rate observed when patients with initial FS during an infection with HHV-6 were compared to those presenting during an infection caused by other pathogens \(^{(6,35-37)}\). Thus, HHV-6 does not seem to have any special role in the pathogenesis of FS or its recurrences relative to other fever causing pathogens.

The frequency of FS after immunization with diphtheria – pertussis – tetanus (DPT) and measles vaccines is 6 to 9 and 24 to 25 per 100,000. The seizures associated with fever soon after immunization should not be considered as a direct adverse effect of the vaccine. Their subsequent clinical course is identical to other FS
and they do not increase the risk for subsequent afebrile seizures or abnormal neurological development \(^{(38-39)}\). The period of greatest risk for FS recurrence after immunization is up to 48 hours following a DPT immunization and 7 to 10 days following measles or measles – mumps – rubella (MMR) immunization \(^{(1)}\).

### 1.4.4 Prostaglandins and cytokines in febrile seizures:

Infective agents initiate an inflammatory reaction and prostaglandins (PG) synthesis in many tissues, including the central nervous system. The substrates for PG synthesis are phospholipids which are converted to arachidonic acid by the enzyme phospholipase. Cyclo-oxygenase enzymes (Cox-1 and Cox-2) convert arachidonic acid to PG precursors, which are converted to various PG by specific PG synthetases.

Several endogenous PG are produced in the brain \(^{(40)}\). PGs have a major role in elaborating fever. PGE2 has a pyrogenic activity and other arachidonic acid metabolites may also contribute to body temperature regulation \(^{(41)}\). The level of PG and arachidonic acid are low in the central nervous system in normal conditions \(^{(9,42)}\). Elevated PGs levels have found in animal brains after chemically or electrically induced convulsions \(^{(9)}\).
After FS in children the concentration of PG F₂ alpha (PGF₂α) in cerebrospinal fluid (CSF) is increased and the highest concentrations are measured during the first 3 hours following the seizure \(^{(9,43)}\). In children, unprovoked epileptic seizures do not seem to increase the CSF level of PGF₂ α \(^{(43)}\). Elevated CSF concentrations of PGE₂ have been found in febrile children without seizures, but possible seizures increase PGE₂ concentrations even more \(^{(44)}\).

Cytokines are soluble proteins or glycoproteins that act as chemical communicators between cells, and as inflammatory mediators but not as effecting molecules. They are produced in leukocytes and other affected cells during infection or aseptic inflammation. Interleukin-1beta (IL-1 beta) has been shown to act as the predominant endogenous pyrogen in fever reaction \(^{(45)}\). It’s effect evidently being linked to PG synthesis. The level of IL-1beta in plasma is increased acutely after FS relative to children with fever alone \(^{(45,46)}\). Furthermore, concentrations of IL-1beta production by lipopolysuccharide-stimulated blood monocytes in vitro is also enhance after a FS relative to the situation in febrile children without seizure \(^{(47)}\). It's not clear how the effect of IL-1beta and other possible endogenous pyrogens is mediated from peripheral tissue to the
central nervous system, where they stimulate PG synthesis during inflammatory states. Suggested theories are transport cytokine system through the blood–brain barrier \(^{(48)}\), or through circumventricular organs, which are specialized areas along the cerebral ventricular surface that have no blood–brain barrier \(^{(41)}\). A neuronal pathway had also been suggested \(^{(49)}\) as vagal stimulation by either IL-1beta or lipopolysuccharide, increases production of PGE2 in the anterior hypothalamus, which can be inhibited, in animal models by vagotomy.

1.5. Clinical features of febrile seizures:

FS are classified into two groups based on their clinical features. Simple FS are those that last less than 15 minutes in their duration, do not have focal features and don’t recur within the next 24 hours. On the other hand, complex FS include those that last more than 15 minutes, have focal features or more than one convulsion within 24 hours\(^{(4,6)}\). The vast majority of FS are simple. Prolonged convulsions occur in fewer than 10% of children with FS, focal features are seen in 4% and recurrent seizures within 24 hours are seen in 16% \(^{(6,50)}\). Generalized seizures are mainly clonic but both atonic and tonic episodes have been noted \(^{(50)}\). Complex FS occur as the initial
convulsions in the majority of children who experience them\textsuperscript{(6)}. An initial simple FS can be followed by a subsequent complex one and vice versa \textsuperscript{(6, 50)}.

Children experiencing a FS usually have significantly elevated body temperature but approximately 25\% of them have temperature between 38\textdegree{}-39\textdegree{}C. Children who have repeated FS do not always experience them with the same degree of fever nor every time the temperature of the preceding FS is reached \textsuperscript{(31, 50)}. The majority of FS are seen on the first day of illness and in some children they are the first sign of the accompanying illness.

Transitory neurological findings in the acute stage following FS are often reported, and the underlying illness maybe a contributing factor. Varying durations of postictal sleep or stupor are common and often secondary to the fever and infection, accompanying electrolyte disturbance or medications rather than the seizure itself. Transient flaccid hemiparesis (Todds pareses) was noted in 0.4-0.5 percent of cases in one study, most of them were normal prior to the FS \textsuperscript{(6)}. The postictal hemiparesis ranges in severity from mild to complete flaccidity and are found within 24 hours following the seizure and usually within 6 hours. Most of the children recover from the
weakness within 24 hours and rarely does it last for more than a week. Children whose FS was followed by Todds pareses were more likely to have a preceding lateralized FS.

Acute cerebellar ataxia is common, it lasts less than a week in three fifths of children experiencing it. Hypertonicity, hypotonicity, positive Babiniski response, reflex abnormalities, fixed pupils and facial asymmetries are other abnormal findings reported (3).

1.6.Differential diagnosis:

The main concern in evaluating an infant or child with a FS is the possibility of underlying central nervous system infection. About 15% of children with meningitis will have seizures, but virtually none are neurologically normal shortly after the seizure (51,52). A thorough evaluation by an experienced physician almost always detects the child with meningitis (53). Meningitis is found in less than 1% of patients with FS, and less than one half of these have bacterial meningitis (3). On the other hand, in children who have meningitis who present with convulsions, as many as 40% may not have meningeal signs, particularly younger infants (54).

Seizures are distinguished easily from other types of involuntary movements occurring in sick infants. Chills (rigors) usually consist of
fine rhythmic oscillatory (high frequency, low amplitude) movements about a joint, and are not clonic in nature. They rarely involve facial or respiratory muscles and are not accompanied by loss of consciousness, which do occur during a generalized seizure\(^3\). Both breath holding attacks and reflex anoxic attacks are immediately preceded by a noxious stimulus and are not accompanied by fever. Syncope, which is unusual in the FS age group, is not accompanied by fever, is less sudden in onset and is always accompanied with bradycardia\(^3\). In benign paroxysmal vertigo, there is sudden onset but the child remains conscious throughout the attack. Finally, tetany can readily be distinguished by the presence of spasms rather than the regular clonic movement and by the retained consciousness \(^3\).

The detection of an underlying metabolic disorder presenting as a seizure in a febrile child is rare. A careful review of the history usually provides other clues suggesting the likelihood of an underlying problem. Hypoglycemia is rarely implicated in the etiology of seizures that occur in association with febrile illnesses. Hyperglycemia is more common; it is suggested to be secondary to failure to transport glucose into the brain in association with viral infection or a reaction to stress. Hypocalcaemia, hypomagnesemia
and hypophosphataemia are rarities (3).

1.6 Work up:

Whether to perform a routine lumbar puncture (LP) for a child presenting with a first FS to exclude meningitis, remains a debate (50, 52, 54). Although several studies have shown that meningitis can occasionally occur with a clinical picture indistinguishable from FS, the risk of bacterial meningitis in the absence of other clinical signs is extremely small (less than one in two hundred) (54). Older children with meningitis have constitutional symptoms, such as headache, and signs of nuchal rigidity. Children under one year of age may not have such obvious signs of meningeal irritation. Based on this, the guidelines for the management of convulsions with fever in the United Kingdom (55) and the American Academy of Paediatric (5) recommend performing LP for any child under 12 month of age. However, LP is not a sensitive predictor of meningitis in this group of patients, missing over 40% of cases if performed routinely on admission to hospital. Furthermore, LP isn't without risks, it has been suggested that there is a risk of introduction of organisms from the bloodstream into the CSF during LP (52). Data from recent studies question the necessity of routine LP and suggest
that clinical information may be used to select children at high risk of meningitis. Five items in the history and examination have been found to discriminate significantly between children who have meningitis and those who have not\(^{(54)}\). These items are: a visit to a physician in the 48 hours prior to the seizure, seizure on arrival at the emergency room, type of seizure (focal vs generalized), suspicious findings on physical examination (rash, petechia, cyanosis, hypotension and grunting respiration) and abnormal findings on neurological examination (stiff neck, increased tone, deviated eyes, ataxia, no response to voice, inability to fix or follow, no response to painful stimuli, positive dolls eye sign, floppy muscle tone and bulging or tense fontanel).

An electroencephalogram (EEG) obtained within one week or less of the FS is abnormal in at least one-third of these children\(^{(50)}\). FS of long duration or of focal features increase the likelihood of those abnormalities. Abnormal EEG results do not identify children in whom epilepsy subsequently will develop and should not be used as the basis for deciding which children need anticonvulsant therapy. Common abnormalities found on acute EEGs are: generalized increased in the slower frequencies which is the most consistent
finding, asymmetries and focal abnormalities usually following lateralized or focal seizure and rarely on occasions true epileptic discharges (Spikes or spikes and wave)\(^{(3)}\).

Determination of serum electrolytes (particularly sodium), glucose, blood urea nitrogen, calcium and phosphorous levels should be reserved for when there is reasonable suspicion that one or more maybe abnormal. It should be noted that a serum sodium under less than 135 mmol/l is associated with recurrent FS within the same illness\(^{(56)}\).

Neuroimaging should not be performed in the routine evaluation of child with a first simple FS, only when an underlying structural lesion is suspected\(^{(5)}\).

1.7. Risk factor for a first febrile seizure:

Bethune et al\(^{(10)}\) has studied risk factors for a first FS, and found that family history of FS in first and second degree relatives was associated with an increase in risk of developing a FS compared with the control population. OR of 5.08 has been found with a history of FS in a first-degree relative and OR of 3.86 with a family history in a second-degree relative.

Day – care attendance, which is defined as care of the child in a
group of more than six children in a nonresidential setting for at least 20 hours per week, has been found to be as important as family history as a risk factor for development of FS with an OR of 3.05. This can be explained by the increased risk day-care attenders have to infectious diseases, particularly respiratory infections, diarrhoea, cytomegalovirus and haemophilus influenzae type B infection\textsuperscript{(10)}.

Delayed neonatal discharge is a marker of neonatal difficulties. Neonatal respiratory distress, sepsis, errors of metabolism\textsuperscript{(57)} and premature birth at less than 37 weeks gestation\textsuperscript{(58)}, has been found to be associated with modest increase in risk of FS and have an OR of 5.63\textsuperscript{(10)}.

Parental perception of slow development in their child has also been implicated as a risk factor\textsuperscript{(10,59)}, with an OR of 4.33\textsuperscript{(10)}. Children with FS were found to experience more febrile episodes per year than their matched controls\textsuperscript{(59)}.

Most of children who have their first FS have none of the above mentioned risk factors, however, the presence of two risk factors or more increase the risk of having a FS to 28% with a range of 20% - 73%\textsuperscript{(10)}. 
1.8. Prognosis:

Although FS is a very frightening event to the parents (58) it carries an excellent prognosis, and no deaths has been reported following it (6). There are three significant risks associated with FS: recurrence, later epilepsy (4,60) and later intellectual impairment (61).

1.8.1. Recurrence:

About one third of children who experience a first FS have at least one recurrence and half of those had a further attack. Factors associated with increased risk of recurrence are: the first FS occurring before one year of age, a history of FS in a first degree relative and low temperature accompanying the first FS (6).

Age at onset is perhaps the single strongest and most consistent predictor of recurrent FS. The younger the child was at the time of the first FS, the greater was the risk of recurrent FS. Half of the children with onset in the first year of life and 28% with onset after the first year had at least one recurrence and 30% compared to 11% respectively, had more than a single recurrence (6,62).

A first degree family history positive for FS (parents or siblings affected by FS) increased a child’s two year recurrence risk from 27% to 52%, where no significant increase of recurrence risk was found.
with affection of second-degree relatives (grandparents and uncles/aunts) or cousins only\(^{(63)}\). Recurrence risk was also significantly correlated with the proportion of first-degree relatives affected by FS: risks were 27, 40 and 83% in children whose proportion was 0, 0-0.5 and > 0.5 respectively\(^{(63)}\).

Children with their first FS who have accompanying temperature of 40°C or more were nine times less likely to have subsequent convulsions, compared with those with temperatures of 38-38.9°C\(^{(64)}\).

Characteristics of the first FS were not useful in the prediction of recurrence. Simple FS were as often followed by recurrence as were first FS with complex features\(^{(6)}\).

The recurrence risk for those with none of the three risk factor was 4%, with one factor 23%, with two 32% and with all three is 62%\(^{(4)}\).

Children who have recurrence are more likely to have them during the following six months of the first FS (50%), and most of them (73%) experience the recurrence in the year following the initial seizure \(^{(6)}\).
1.8.2. Epilepsy:

Only 2% to 4% of children with a first FS subsequently develop epilepsy \(^{6,65-66}\), compared to 0.4% risk of epilepsy in children with no FS \(^6\). Verity\(^7\), in a national population based study, identified 398 children who experience at least one FS which represent 2.7% of the cohort, 16 of them were neurologically or developmentally abnormal prior to the seizure. Of the remainder, 13 developed afebrile seizures (3.7%), a higher proportion of children with complex FS developed epilepsy compared to simple (6.3 vs 1%) the risk been highest for those with focal FS (29.4%). Nelson and Ellenberg\(^6\) in their study showed that a history of afebrile seizures in a first degree relative (parent or sibling) increased the likelihood of subsequent developing epilepsy three-folds in children with FS. These studies concluded that risk factors for later epilepsy were abnormal neurological or developmental status prior to the first FS, a family history of afebrile seizures and an initial complex seizure. Sixty percent of children with FS have none of these risk factors and a subsequent risk of epilepsy is only 0.9%.

About 2% of children with one factor (34% of children with FS) and 10% of those with two or more risk factors (6% of children with
FS) will later develop epilepsy \(^{(4,6,66)}\). Age at onset, race, sex and family history of FS did not contribute significant additional predictive power to the above-mentioned risk factors \(^{(6)}\). In contrast, MacDonald et al \(^{(67)}\) followed up children with FS for 12 years through The National General Practice Study of Epilepsy and has reported 6% risk of developing epilepsy after a FS compared to a population risk of 1.4%. 10% of his cohort developed neurological sequelae and he didn’t find statistical significance between complex FS and later development of epilepsy.

When epilepsy does develop, the seizures can be virtually of any type although the highest association is with generalized rather than partial seizures \(^{(68-69)}\). Although it was reported that children with FS developed atypical absence attacks more frequently than did children who had no FS \(^{(6)}\), this increase was not greater than the increase in risk of epilepsy of all types after FS \(^{(6)}\).

Approximately 15% of children with epilepsy have one or more preceding FS, regardless of the cause \(^{(68)}\). This observation suggests that the tendency for FS plays an important role in a person’s seizure threshold.
Mesial temporal sclerosis (MTS) is a disease of the limbic system in which the hippocampal formation is the most profoundly affected structure, where loss of neurons in the H1, Sommer, sector is the characteristic finding. The H2 sector is resistant to damage during seizures. Falconer\textsuperscript{(3)} have performed an en-block dissection of the affected temporal lobe on hundred of patients with drug resistance epilepsy and found MTS in about half of the cases. In another series, 75\% of children having MTS had a history of FS. Studies have suggested that temporal lobe epilepsy (TLE) patients with a history of FS have more frequent and more intense sclerotic changes in mesial structures than TLE patients with no history of FS. All the studies pointing to a connection between FS and MTS have been retrospective and their patients selected, so there is no true evidence to support the speculated causal relation between FS and MTS.

1.8.3 Intellectual impairment:

Several prospective population based case control studies were conducted to assess the effect of FS on the later intellectual and cognitive function of the brain\textsuperscript{(6,61,70-72)}. General intelligence and academic achievement was found to be normal in children at school
age who had experienced FS and were known to be normal prior to the first attack, even in those with FS lasting more than 30 minutes\textsuperscript{(70)}.

The development of afebrile seizures after FS was associated with a five fold increase in frequency of mental retardation (IQ less than 70). Intellectual impairment was particularly frequent in children who developed minor motor epilepsy\textsuperscript{(70)}.

Except where neurological or developmental abnormality predated any seizure or there were subsequent development of epilepsy, FS were not associated with an increase in risk of intellectual impairment \textsuperscript{(5)}.

Children with FS were found to have better reading skills\textsuperscript{(61)}, mnemonic capacity, more flexible mental processing abilities\textsuperscript{(71)} and better control of distractability and attention\textsuperscript{(72)} at school-age when assessed with age-matched controls.

Although FS children were found to have higher impulsitivit\textsuperscript{(71)}, and mothers rated their children as more anxious\textsuperscript{(61)}, no significant differences were found between FS children and their matched controls regarding behavior\textsuperscript{(61,70)}. 
1.9 Treatment:

FS are usually brief and self-limited. When the seizure occurs, the child should be placed on its side or stomach on a protected surface, observed carefully, and brought to an emergency facility. If the seizure lasts longer than 10 minutes\(^\text{(4)}\). In most cases a feverish child is taken to a medical facility after the seizure has ended. If the convulsion is still active, the child airway should be kept clear, oxygenation maintained and intravenous or rectal anticonvulsants such as diazepam or lorazepam given to halt the seizures \(^\text{(4)}\). Measures to lower the fever like tepid spongings, although frequently advised to perform, have not been shown to reduce temperature \(^\text{(73)}\).

Antipyretics differ in their mechanism by which they act. Acetaminophen, a well-known and widely used antipyretic and analgesic, acts on the central nervous system by lowering the thermoregulation set point. Acetaminophen in a dose of 10 mg/kg four times per day has been shown to reduce temperature by about 1.5\(^\circ\)C \(^\text{(33,74)}\).

Ibuprofen, a member of the non-steroidal anti-inflammatory family has an antipyretic, anti inflammatory and analgesic effects. Works through inhibition of arachidonate cyclo-oxygenase and thus
inhibition of PG production and return of the temperature regulating centre to the normal set point. Studies showed that, ibuprofen in a dose of 10mg/kg yielded greater temperature decrement and longer duration of antipyresis than acetaminophen.

A thorough history and examination and appropriate laboratory investigations usually reveals the underlying cause of fever, and management is directed as appropriate.

The best treatment for children in the first FS is education and reassurance of their parents. Parents should be counseled that family routines will be disrupted for several weeks, but life would continue and their child will do well.

1.10 Prevention:

Because fever is an essential element for the genesis of FS, it would seem correct that antipyretic medication would prevent the first or recurrent FS. Several studies have shown that appropriate and rigorous use of antipyretic medication does not prevent a FS. A finish study randomized children to receive placebo or acetaminophen (10mg/kg) at the time of illness for two years following a FS. Those receiving placebo had recurrent FS during 8.2% of febrile illnesses, compared with 5.2% for those receiving
acetaminophen (33). A similar randomized study of ibuprofen syrup administered during a febrile illness to prevent seizure recurrences also was ineffective (79). Short-term anticonvulsant therapy used during the febrile illnesses was found to be effective in preventing recurrences in some studies (80), where other studies showed ineffectiveness (33). Prophylactic daily therapy of phenobarbital or valproate may reduce recurrence of FS (60, 78, 81), but the side effects of these anticonvulsant outweigh the benefit. Reports of fatal hepatitis or pancreatitis in children using valproate - although rare - restrict its use (62). On the other hand, phenobarbitone has been proved to depress cognitive functions in children with FS, which outlasts the administration of the drug by several months (81). Other anticonvulsants such as carbamazepine and phenytoin are ineffective (4, 50).

1.10 Psychological impact and knowledge attitudes and practice of parents of children with febrile seizure (FS):

FS is benign, does not cause death, brain damage or learning disorders and has a good prognosis (6). Despite this it’s quite frightening for the parents and most of them would think that the child is dying (82-84). On witnessing an attack, parents voiced out that FS
are harmful and damaging, and the child looked injured after the attack \(^{(85)}\). The most important sequelae appear to be parental anxiety and subsequent labeling the child as vulnerable.

FS has its shadows on the family’s life for a long period of time. Sleep disturbance and signs of insecurity and restriction of the quality of the family's life is usually experienced \(^{(80,84)}\). Each subsequent febrile episode would be a nightmare to the parents due to fear of it's recurrence.

A study was conducted in Switzerland\(^{(84)}\) to assess the effect of FS on the behavior and emotional situation of the parents. 91% of the parents reported severe anxiety on witnessing the first FS, in 69% the anxiety was so severe that the parents believed their child would die. 48% feared a disturbance in the child future development due to FS. Severe anxiety was significantly associated with lack of knowledge about FS and low educational level. A significant number of parents suffered from sleep disturbance, which persisted for weeks to months, and new symptoms such as headache and nervousness appeared in some of them. Anxiety reappeared in 93% of parents with a new attack of fever in their child.

Inappropriate and even harmful practices are also encountered
during an attack of FS, these are most likely to be due to lack of knowledge of FS accompanied by misconceptions of the risk of choking, tongue biting, injury, brain damage and epilepsy.

In an Indian study\(^{(86)}\) assessing knowledge, attitude and practice (KAP) of parents of children with FS, FS wasn’t known to a significant percentage of parents prior to their first attack. The seizures was only recognized by 40% of parents in the study group, other thought their child was suffocated, had altered consciousness, was shivering or the seizure was a result of drug interaction. About the practice, most of the parents rushed to hospital without intervention, some applied harmful practices such as shaking the child and application of an onion to the nostrils with forceful closure of the mouth to arouse the child. Few knew the risk of aspiration and a very few knew measures to prevent it.

Rutter\(^{(87)}\) in his study to find out medical and parental management of children with their first FS, showed that most of the care-givers were very frightened or in panic state and were over whelmed to response, many sought help by calling some one nearby. Some had harmful practices such as shaking the child, try to open his mouth, cardiac massage and forceful closure of mouth. Only a few
parents laid the child on his side and waited for the fit to stop\textsuperscript{(87)}.

In Taiwan, Huang\textsuperscript{(1,83,88)} conducted a study to assess KAP between parents of children with their first FS. He reported that false beliefs and reliance on folk medicine was not prevalent, but a high proportion of parents perceived that FS is a form of epilepsy and anticonvulsants are required, recurrent FS would damage the brain and EEG and computered tomography (CT) of the brain are mandatory for any child with FS\textsuperscript{(1,83,88)}.

Educational programme for parents have been demonstrated to significantly improve information about FS and their prognosis but they have little effect on parental anxiety and fears\textsuperscript{(1,83,88-89)}.

In an African study\textsuperscript{(90)} conducted in Kenya, KAP of home management of FS was assessed and compared between mothers from the urban and rural communities. The majority of mothers from the rural area were not aware that fever is a cause of FS and attributed the cause to witchcraft, evil spirits; abnormalities in the spleen (worms or nerves in the spleen, twisted or enlarged spleen) and some related the seizures to hereditary causes. Inappropriate and harmful practices were performed to the children during the seizure. Forceful opening of the mouth (to prevent choking and giving
drugs), putting feet near the fire and pouring cold water on the child to arouse him were some of them. Traditional medicine was permissive of use of all rural mothers and almost all urban mothers. For treatment of FS various constituents were used ranging from sent leaves, palm and coconut oil to crude oil, kerosine and urine (human or cow). These medications are applied topically, orally, rectally or inhaled and each of these routes of applications carries its risks.

Ahmed(91) studied KAP of parents of children with epilepsy. Most of parents attributed the cause of epilepsy to an abnormality in the brain and 26.6% thought it was due to an evil eye. Lower levels of knowledge were observed regarding the effects of the acute attack. Majority of parents felt helpless and took no reaction, some changed the child’s position during the attack but not to a position that prevents aspiration, and some tried to stimulate the child by pouring cold water on him. 11.4% of parents believed in traditional healers and a significant number of them used religious rituals and Mihaaya.

Abdallah(92) conducted a hospital based study to detect the clinical pattern of children with FS presenting to Khartoum Children Emergency Hospital. He found a prevalence of 1.8% among them and a mean age of 30.3 months. The male to female ratio was
Abdallah observed the attitude of the parents, particularly the mother who is quite frequently the first person to witness the seizure, and found most of them were extremely terrified and in panic state after onset of the convulsion which prevented useful intervention during the seizure. 74% of the parents remained inactive, 25.7% applied anti pyretic measures and none tried first aid measures for the seizures. No deaths, neurological or behavioral deficit were encountered in those children.
JUSTIFICATION:

Febrile seizures (FS) is a common paediatric problem, which causes severe psychological reaction in the parents. Besides, there are many wrong traditional and local methods of management as a result of lack of proper knowledge of FS by the parents. Only one study has been conducted on FS in Sudan investigating the clinical pattern of FS, but no study on parent’s knowledge, attitude, practice and psychological impact of FS on the parents has been done before.
OBJECTIVES:

1- To study the clinical types and relative risk factors in children presenting with febrile seizures (FS).

2- To study the knowledge, attitude and practice of parents toward their children with FS.

3- To investigate the affect of FS on the behavior and emotional situation of the parents.
Chapter Two
2- Patients and Methods

2.1. Study design:

Is a hospital based case control study.

2.2. Study area:

The study was conducted in some emergency children hospitals in Khartoum state. The hospitals were:

1. Khartoum Children Emergency Hospital (KCEH).

2. Mohamed Alamin Hamid Children’s Hospital, Omdurman.

3. Ahmed Gasim Children Hospital, Khartoum North.

2.3. Study duration:

The data was collected in the period between the 1st of March 2004 and the 5th of July the same year.

2.4. Study population:

Children admitted in the above mentioned hospitals with a confirmed diagnosis of febrile seizures were the subject of the study.

2.4.1. Case definition and inclusion criteria:

A febrile seizure child was defined as a previously normal child, aging between 6 months and 6 years presenting with a fever associated seizure with exclusion of any acute neurological illnesses.
or metabolic abnormalities.

Any child presenting with a fever-associated seizure below the age of 18 month has undergone a lumbar puncture to exclude meningitis. If the seizure was a recurrence, a thorough physical examination was done to exclude any abnormal neurological signs and identify the underlying cause of fever then appropriate laboratory investigations were done. Children with ages above 18 months were examined for abnormal neurological signs (including signs of meningeal irritation) and for an underlying cause of fever then investigated. Children were observed for a minimum of 24 hours in hospital with treatment of the possible underlying cause of fever.

* Controls: Each case was age-matched to within 6 months to two febrile and two afebrile controls who had never had a seizure. Controls presented to the emergency department within 10 days of the presentation of the febrile seizure child.

2.4.2: Exclusion criteria:

Children with any of the following were excluded from the study:

1. Children with fever associated seizures age less than 6 month or more than 6 years (72month).

2. Previous afebrile seizure.
3. Known neurologic abnormality (e.g. cerebral palsy).
4. Meningitis or encephalitis; by examining the CSF.
5. Suspicious neurological findings after the seizure: loss of consciousness, weakness and others.
6. Refusal of parents or guardians to participate in the study.

Controls were not included if they had a past history of afebrile or febrile seizures, were neurologically abnormal or parents refuse to participate in the study.

2.5. Sample size:

Sample size calculation was based on 2 sided significance test. The calculated sample size was 116 cases and 464 controls (ratio of 1:4) and this would detect an odd’s ratio of 3.86 or more at a population prevalence of the risk factors of 2.7% with a power of 80% and type I error of 0.5. The calculation was performed using Epi Info 2000 – Statcalc routine and used estimates of odd’s ratio and control prevalence of risk factors from a previous study\(^\text{(10)}\).

2.6. Research tools:

The parents or caregivers were contacted and informed about the purpose of the study then consented and personally interviewed by the author with the help of a pre-structured questionnaire.
The questionnaire was composed of six parts.

The first part obtained personal data of the child and his parents. The second part obtained data considering the febrile seizure; whether it was first or recurrent, its clinical type, risk factors for a first febrile seizure and, in cases of recurrence, risk factors for a recurrent FS.

The third part of the questionnaire was for assessing the knowledge of the parents toward febrile seizure. The knowledge was about the nature of febrile seizure, natural history, possible provoking factors, complications during the seizure and management. The fourth part was composed of questions to assess the general attitude of the parents toward FS and questions to identify the possible role of traditional medicine in FS management.

The fifth part was used to obtain data about practices during the current seizure: recommended first aid practices and non-recommended practices. It also included questions about recognition of the seizure, thoughts at that time and immediate effects of the seizure on the parents.

For assessing the psychological impact of the seizure on the witnessing parent, the sixth part of the questionnaire included the
Arabic translation of the State-Trait Anxiety Inventory (STAI)\(^{(93)}\). The inventory is a research instrument for the study of anxiety in adults and a self-reported assessment device, which includes separate measures of state, and trait anxiety. According to the author, state anxiety reflects and transitory emotional state or condition of the human organism, that is characterized by subjective consciously perceived feelings of tension and apprehension and heightened autonomic nervous system activity. Scores on the STAI have a direct interpretation, high scores on their respective scales means more trait or state anxiety and low scores mean less.

### 2.7. Data entry and statistical methods:

The data obtained from the questionnaire was entered into the computer and analyzed using statistical package of social sciences (SPSS). Descriptive and comparative statistics were performed. Chi-square test was used in assessing the effect of general characteristics on attaining the required knowledge. Student-t test was used to compare between means. Epi-Info 2000 Statcalc routine program was used to calculate relationships between the risk factors and the development of FS and Odd Ratios and relative risks (RR) obtained.
**Scoring system:** A scoring system was used to assess the general knowledge of parents of FS children whom were included in the study. Using scores of one and zero for correct and incorrect responses respectively. The total of responses were analyzed a cut-off point of 60% was used to divide the responses to good and poor knowledge according to a previous study\(^{(94)}\). Scores more than 60% were considered as good knowledge and scores equal to or below 60% were considered as poor knowledge.

The inventory, which was used in this study to assess the anxiety level of the parents, was not adjusted to be used in the Sudanese environment. So using the original inventory to analyze the results of our study was not feasible. In general the inventory scored high in individuals with high anxiety and low in those with low anxiety. The possible highest score was 80 and the possible lower score was 20. There was 60 grades between them which were divided equally to represent mild, moderate and severe anxiety on the scale. So mild anxiety was considered with scores from 20 to 40, moderate anxiety with scores from 41 to 60 and severe anxiety with scores from 61 to 80.
2.8. Input of the author:

The role of the author was to:

1. Design the study and questionnaire.
2. Make necessary contacts and permissions.
3. Conduct full history and physical examination and make appropriate investigations to confirm the diagnosis.
4. Interview the parents or guardians and fill the questionnaire.
5. After interviewing the parents the author sits with them and educate them about FS (natural course and prognosis), corrects wrong concepts (if any) and teach the parents suitable first aid practices to be applied during the seizure.
6. Collects the control.

2.9. Ethical consideration:

- Approval consent of the study was taken from our local committee of Paediatric and Child Health University of Khartoum.
- Parents of children with febrile seizures and controls were informed about the purpose of the study and then consented and interviewed.
• Informed consent was also taken from the different health authorities.

• Counseling and health education was given to the parents after completion of the questionnaire.
Chapter Three
3- RESULTS

A total of 116 children with a confirmed diagnosis of FS were included in this study. The witnessing parent was interviewed using the questionnaire and data obtained.

3.1. Socio-demographic characteristics of the study group and their parents.

3.1.1. Age and sex of the FS children:

The age of the children under the study ranged between six and 72 month with a mean age. 22.4 month ± 14.3 (mean ± SD). 60.3% of them were males and the remainder (39.7%) were females, male to female ratio was 1.5 : 1 (Figure 1).

3.1.2. Origin:

17 of the children (14.7%) were from Central Sudan, 39 (33.6%) from Northern Sudan, 1 (0.9%) from Eastern Sudan, 48 (41.4%) from western Sudan and 11 (9.5%) from the South (Figure 2).
3.1.3. Parents age, educational level and occupation:

In the sample mean age of the mothers was 29.8 ± 5.6 years (mean ± SD) as shown in table 1 and mean age of fathers was 38.9 ± 6.8 years (mean ± SD).

29 of the mothers (25%) were illiterate, 43 (37.1%) received Khalwa or only primary school education, 32 (27.6%) received secondary school education and only 12 (10.3%) had university or higher-grade education (Figure 3).

14 of the fathers (12.1%) were illiterate, 49 (42.2%) received Khalwa or primary school education, 38 (32.8%) had secondary school education and 15 (12.9%) had university and higher-grade education (Figure 3).

The majority of the mothers were housewives with a percentage of 84.5%, 4 (3.4%) were labourers, 13 (11.2%) were employee and only one mother (0.9%) was a professional (Figure 4).

Only 2 of the fathers (1.7%) were without job, 35 (30.2%) were skilled labourers, 28 (24.1%) were employee, 47 (40.5%) were unskilled labourers and 4 (3.4%) were professionals (Figure 5).
3.2. The febrile seizure:

3.2.1. First or recurrent FS:

In 74 of the children (64.7%) it was their first attack and in the remainder, 42 (35.3%) the FS was a recurrence (Figure 6). In children with recurrences 22 presented with their second attack, 9 with their third attack, 7 with their forth attack, 2 with their fifth attack and two presented with their seventh attack of FS as shown in figure 7.

3.2.2. Type of the febrile seizure:

Simple FS occurred in 70 (60.3%) of study group. The remainder 46 (39.7%) had a complex seizure (Figure 8). Of the children who had complex features, 6 had a focal seizure, in 14 the seizure lasted more than 15 minutes and 34 had more than one attack of seizure within 24 hours (Figure 9). Some having two features of complexity.

In children with recurrences 25 had a complex seizure, presenting 54.3% of total children with complex seizures. 18 were more than one seizure in 24 hours, two were focal and two lasting more than 15 minutes in their duration and three children had two features or more (Figure 10).
3.2.3. Age of the child and FS:

63 (54.3%) of the children under the study were aged 18 months and below, 32 (27.6%) were more than 18 months and up to 36 months of age, 21 (18.1%) were aged more than 36 and up to 72 month (Table 2). In cases of recurrences, 25 (58.5%) had their first attack of FS when aged one year and below, 34 (80.4%) when aged 18 months and below and almost all 38 (90.2%) when they reached two years of age (Table 3). Children presenting with their first FS had a mean age of onset of 18.3 ± 11.4 month (mean ± SD), mean age of children with recurrence for a first attack of seizure was 13.9 ± 7.8 months (mean ± SD) and mean age for a first febrile seizure in the study group was 16.1 ± 9.6 months (mean ± SD) as shown in table 4. There was a statistically significant difference in age of the first presentation between children presenting with their first and recurrent FS (P.Value=.0001).

3.3. Risk factors for a first febrile seizure:

There was no difference between the study and control groups regarding age, mean age of controls was 23.7 ± 15.9 months (mean ± SD). A positive family history for a FS in a first degree relative was found in 26 (22.4%) of the study group compared to 31
(6.7%) of the 464 controls with an odd ratio of 4.04 and a relative risk of 2.65 (Table 5).

A positive family history of FS in a second degree relative was found in 10 (8.6%) of the study group compared to 6 (1.3%) of the control group with an OR of 7.20 and a relative risk of 3.33 (Table 5). Parental perception of slow development was stated by the parents of 13 (11.2%) children from the study group compared to 5 (1.1%) of the control group; with an OR of 11.59 and a relative risk of 3.94 (Table 5).

None of the children in the study group were discharged from the nursery after 28 days or admitted to the neonatal ward at all. Compared to one child (0.2%) in the control group (Table 5).

62 (53.4%) of the study group had none of the risk factors.

3.4. Risk factors for a recurrent FS:

In children with a recurrence, the first seizure occurred before 1 year old in 20 (47.6%) of the 42 children and a positive family history of FS in a first-degree relative was found in eight (Table 6).

3.5. Knowledge:

Various FS knowledge aspects of the witnessing parent were assessed using the third part of the questionnaire.
3.5.1. Knowledge of FS prior to the attack:

97% of the interviewed parents knew before that fever can cause convulsion and in only 3 it was the first time to see or hear about it.

3.5.2. Possible direct underlying cause of FS:

86.2% related the cause directly to fever. 6.9% mentioned that the only possible cause is witchcraft and another 6.9% related it directly to an evil-eye, but fever can be a provoking factor. Not related the cause to an underlying brain abnormality or perinatal events (Figure 11).

3.5.3. Causes of fever:

About the causes of fever that brings on a seizure, 102 attributed the cause to acute respiratory tract infections, 91 to gastroenteritis, 105 to malaria, 37 to fever following vaccination. 12 couldn’t differentiate between FS and meningitis as they mentioned that FS can be triggered by meningitis and encephalitis. 30 implicated teething as a cause of fever and thus seizures (Figure 12).
3.5.4. Nature of FS:

FS was considered a type of epilepsy in 39 of the parents while the majority considered it benign. 29.3% believed that FS runs in families.

52.6% of parents mentioned that FS is age dependent, and remits after 6 years. The remainder though it is a life long condition and that the child would convulse whenever getting a fever.

48.3% of the parents claimed that every child with a FS would certainly have another attack with another episode of fever, others mentioned that they may or may not.

3.5.5. Duration and remission of FS:

Most of the parents mentioned that the usual duration of the seizure is seconds to a few minutes, only 19 mentioned that it lasts for hours.

The seizure remits spontaneously in only 28.4%, others thought that intervention such as tepid sponging or intravenous or intrarectal diazepam only aborts the fit, and if no intervention has been applied the seizure goes on for hours.
3.5.6. Knowledge of risks during an attack of seizure:

Only a minority of the parents knew the acute complication of the seizure that occurs during the attack. Aspiration was known by 26.7%, injuries by 19.8% and cardiac arrest to 2.6%. Most of the parents related these risks to epilepsy and FS is not epilepsy (Figure 13).

3.5.7. Options of management:

Specific investigations like computed tomography (CT), LP and EEG were considered a necessity in 32.8% of parents, and neurological assessment and follow up in 49.1% (Figure 14). Directing the treatment to the underlying cause of fever and antipyretic were quite enough in treating the condition in 67.2% of the parents, while 33 voiced out that anti-convulsants should be a cornerstone of management. 4.3% of the parents considered none of either treatment plans as satisfactory and that traditional treatment is the only option (Figure 15).

3.5.8. FS and immunization:

Fortunate enough, the great majority of responders (87.9%) didn’t accept an attack of FS as a cause to postpone vaccination.
3.5.9. Source of information:

The source of information was mainly obtained from neighbors and relatives (77.6%), while media (television and radio) 9.5% and medical personnel (12.9%) played a weak role in health education (Figure 16).

3.6 Attitude:

3.6.1. FS and epilepsy:

FS was an antecedent for later developing epilepsy in 62.1% of the parents and a major life threatening event.

3.6.2. Effect of FS on the child:

Only 22.4% of the responders mentioned that FS could pass uneventful without harming the child. Other claimed that FS causes paralysis (71.6%), brain damage and mental retardation (56.9%) and death (39.7%) as shown in figure 17.

3.6.3. Role of traditional medicine in the treatment of FS:

Traditional medicine was strongly advocated by 30.2% of the responders (Figure 18). Table 7 summarizes some of the commonly used by the parents.
3.6.4. Hazards of intervention during the attacks:

Although most of mothers avoided touching their children during the seizure only 31 of them voiced out that touching the child during the seizure by the mother causes paralysis. Some mentioned manipulating or touching the child causes fractures. On the other hand, some parents mentioned that not pressing the child during the seizure causes deformity (Table 8).

3.6.5. The overall look of the FS child:

The child with FS was not considered as his siblings in 75 of the parents, needing more care and attention (Figure 19) but almost all (93.1%) of them were not ashamed to have a child with FS.

3.7. Practice:

3.7.1. First aids during a seizure:

First aids to be applied during a seizure was known by few parents and performed by fewer. The most known was lowering the child temperature (80.2%) but only performed by 46.6% of the parents. Other measures like protecting on a safe soft surface (15.5%), laying the child on his side (14.7%), being calm (14.7%) and observing the seizures duration and manifestation (16.4%) was
known by a lesser degree and performed by a more lesser degree (Figure 20).

3.7.2. Non recommended practices during a seizure:

Non-recommended practices were observed in 82% of the parents. 30 (25.9%) rushed to the nearest emergency hospital without intervening and 41 (35.3%) were too overwhelmed to response. The remainder had even harmful practices such as trying to open the convulsing child mouth putting objects, restraining the convulsing child, shaking to arouse the child and applying cardiac massage (Figure 21).

3.7.3. Recognition of the FS:

The seizure was recognized in the majority of the parents, inspite the fact that 86 of the parents though their child was dying.

3.8. Psychological impact of the seizure on the witnessing parent:

3.8.1. Immediate effect of the seizure on the witnessing parent:

The predominant immediate effect was crying (71.6%) and all of them were mothers, followed by gastrointestinal symptoms (48.3%) and then headache, insomnia and tremors (25.9%). Fainting was observed in only two (1.7%) as shown in figure 22.
3.8.2. Results of STAI:

We managed to assess the anxiety level of 115 parents using the state part of STAI. Nine of the parents (7.8%) had mild anxiety (40 and less), 33 (28.7%) had moderate anxiety (41-60) and 73 (63.5%) had severe anxiety (61- up to 80) as shown in table 9.

3.9. Knowledge score:

The possible maximum score for the correct answers in knowledge-oriented questions was 22, and the attained scores by the interviewed parents ranged between 5-19, the mean ± SD was 13.16 ± 3.02. Good knowledge (more than 60% of correct answers) was found in 48 (41.4%) and poor knowledge in 68 (58.6%) of the responders (Figure 23).

3.10. Effect of some variables on the knowledge score:

When considering the effect of educational level of the informant (P = 0.513), family history of FS in first-degree (P = 0.575) or second-degree (P = 0.563) relatives or first or recurrent FS (P = 0.525), no statistical significance was found in attaining higher scores (Table 10).
3.11. Effect of some variables on the anxiety level score:

When assessing the knowledge score in correlation with the level of anxiety it was found that higher scores of knowledge was significantly associated with attaining lesser degrees of anxiety (P.Value = .008) as shown in table 11.

Other variables such as informant educational level (P = 0.951), family history of FS in first-degree (P = 0.687) or second-degree relatives (P = 0.446) or first or recurrent seizure (P = 0.338) were not found to be correlated with attaining lower scores on the anxiety scale (Table 11).
Table (1):

Showing age of mothers

<table>
<thead>
<tr>
<th>Mothers age</th>
<th>Frequency</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>15 - &lt;20</td>
<td>2</td>
<td>1.7</td>
</tr>
<tr>
<td>20 - &lt;30</td>
<td>47</td>
<td>40.5</td>
</tr>
<tr>
<td>30 - &lt;40</td>
<td>58</td>
<td>50</td>
</tr>
<tr>
<td>40 ≤</td>
<td>9</td>
<td>7.8</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td><strong>116</strong></td>
<td><strong>100</strong></td>
</tr>
</tbody>
</table>
## Table (2):

Distribution of the study group according to age

<table>
<thead>
<tr>
<th>Age (months)</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-18</td>
<td>63</td>
<td>54.3</td>
</tr>
<tr>
<td>19-36</td>
<td>32</td>
<td>27.6</td>
</tr>
<tr>
<td>37-72</td>
<td>21</td>
<td>18.1</td>
</tr>
<tr>
<td>Total</td>
<td>116</td>
<td>100</td>
</tr>
</tbody>
</table>
Table (3):

Age at 1st presentation in children with recurrences

<table>
<thead>
<tr>
<th>Age at 1st presentation</th>
<th>No.</th>
<th>%</th>
<th>Cumulative percent</th>
</tr>
</thead>
<tbody>
<tr>
<td>6-12</td>
<td>25</td>
<td>58.5</td>
<td>59.5</td>
</tr>
<tr>
<td>13-18</td>
<td>9</td>
<td>21.4</td>
<td>80.9</td>
</tr>
<tr>
<td>19-24</td>
<td>4</td>
<td>9.8</td>
<td>90.4</td>
</tr>
<tr>
<td>25-30</td>
<td>2</td>
<td>4.9</td>
<td>95.2</td>
</tr>
<tr>
<td>31-36</td>
<td>2</td>
<td>4.9</td>
<td>100</td>
</tr>
<tr>
<td>Total</td>
<td>42</td>
<td>100</td>
<td>100</td>
</tr>
</tbody>
</table>
Table (4):

Mean age of children for a first FS

<table>
<thead>
<tr>
<th></th>
<th>Mean age ± SD (month)</th>
</tr>
</thead>
<tbody>
<tr>
<td>Children presenting with a first FS</td>
<td>18.3 ± 11.4</td>
</tr>
<tr>
<td>Children presenting with a recurrent seizure</td>
<td>13.9 ± 7.8</td>
</tr>
<tr>
<td>All children in the study</td>
<td>16.1 ± 9.6</td>
</tr>
</tbody>
</table>

P. Value : .0001
Table (5):

Risk factors for a first febrile seizure

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>Study No.</th>
<th>Study %</th>
<th>Control group No.</th>
<th>Control group %</th>
<th>OR</th>
<th>Relative risk</th>
</tr>
</thead>
<tbody>
<tr>
<td>Positive family history in 1&lt;sup&gt;st&lt;/sup&gt; degree relative</td>
<td>26</td>
<td>22.4</td>
<td>31</td>
<td>6.7</td>
<td>4.04</td>
<td>2.65</td>
</tr>
<tr>
<td>Positive family history in 2&lt;sup&gt;nd&lt;/sup&gt; degree relative</td>
<td>10</td>
<td>8.6</td>
<td>6</td>
<td>1.3</td>
<td>7.20</td>
<td>3.33</td>
</tr>
<tr>
<td>Neonatal discharge after 28 days</td>
<td>-</td>
<td>-</td>
<td>1</td>
<td>0.2</td>
<td>-</td>
<td>-</td>
</tr>
<tr>
<td>Parental perception of slow development</td>
<td>13</td>
<td>11.2</td>
<td>5</td>
<td>1.1</td>
<td>11.59</td>
<td>3.94</td>
</tr>
<tr>
<td>None</td>
<td>62</td>
<td>53.4</td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
</tbody>
</table>
**Table (6):**

**Risk factors of a recurrent seizure**

<table>
<thead>
<tr>
<th>Risk factor</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>1\textsuperscript{st} seizure occurring before 1 year old</td>
<td>20</td>
<td>48.7</td>
</tr>
<tr>
<td>Positive family history in 1\textsuperscript{st} degree relative</td>
<td>8</td>
<td>19.5</td>
</tr>
</tbody>
</table>
Table (7):

Types of traditional management of FS as stated by some parents (n=35)

<table>
<thead>
<tr>
<th>Type of management</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Cauterizing the child’s forehead with a burned straw 3 times by a left handed person</td>
<td>11</td>
<td>31.4</td>
</tr>
<tr>
<td>Visiting Al-Sheikh</td>
<td>10</td>
<td>28.5</td>
</tr>
<tr>
<td>Higab – Mahaya</td>
<td>3</td>
<td>8.6</td>
</tr>
<tr>
<td>Bakhour &amp; Azaaim</td>
<td>3</td>
<td>8.6</td>
</tr>
<tr>
<td>Fogaraa &amp; Aroog</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>Cutting a rosary on the convulsing child &amp; Opening a Houg</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>Drawing a line on the child’s forehead by Sultan’s charchet powder &amp; rubbing the body with aster</td>
<td>2</td>
<td>5.7</td>
</tr>
<tr>
<td>Soaking millets in water (millets take the disease)</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td>Bathing the child 7 times in the place where the seizure occurred</td>
<td>1</td>
<td>2.9</td>
</tr>
<tr>
<td><strong>Total</strong></td>
<td>35</td>
<td>100</td>
</tr>
</tbody>
</table>
Table (8):

Hazards during the seizures as mentioned by some parents in the study

<table>
<thead>
<tr>
<th>Hazards</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mother holds the convulsing child causes paralysis</td>
<td>31</td>
<td>26.7</td>
</tr>
<tr>
<td>Manipulating or touching the convulsing child causes fracture</td>
<td>9</td>
<td>7.8</td>
</tr>
<tr>
<td>Not pressing the convulsing child causes deformity to the child</td>
<td>1</td>
<td>0.9</td>
</tr>
</tbody>
</table>
Table (9):

Anxiety level of the parents as assessed by the state trait anxiety inventory (STAI)

<table>
<thead>
<tr>
<th>Anxiety level</th>
<th>No.</th>
<th>%</th>
</tr>
</thead>
<tbody>
<tr>
<td>Mild anxiety</td>
<td>9</td>
<td>7.8</td>
</tr>
<tr>
<td>Moderate anxiety</td>
<td>33</td>
<td>28.7</td>
</tr>
<tr>
<td>Severe anxiety</td>
<td>73</td>
<td>63.5</td>
</tr>
<tr>
<td>Total</td>
<td>115</td>
<td>100</td>
</tr>
</tbody>
</table>
### Table (10):

**Effect of some variables on the knowledge score (poor or good) among the parents of the children under the study (n=116)**

<table>
<thead>
<tr>
<th>Variable</th>
<th>Poor</th>
<th>Good</th>
<th>$X^2$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education level of the informant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mother</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Illiterate</em></td>
<td>16(66.7%)</td>
<td>8(33.3%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Quaraan &amp; primary school</td>
<td>24(58.5%)</td>
<td>17(41.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Secondary school</td>
<td>15(46.9%)</td>
<td>17(53.1%)</td>
<td>2.299</td>
<td>.513</td>
</tr>
<tr>
<td>*University &amp; postgraduate</td>
<td>7(58.3%)</td>
<td>5(41.7%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Father</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><em>Illiterate</em></td>
<td>2(100%)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Quaraan &amp; primary school</td>
<td>3(100%)</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Secondary school</td>
<td>1(50%)</td>
<td>1(50%)</td>
<td>2.917</td>
<td>0.233</td>
</tr>
<tr>
<td>*University &amp; postgraduate</td>
<td>-</td>
<td>-</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Type of seizure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* First seizure</td>
<td>45(60.8%)</td>
<td>29(39.2%)</td>
<td>0.404</td>
<td>0.525</td>
</tr>
<tr>
<td>* Recurrent</td>
<td>23(54.8%)</td>
<td>19(45.2%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Family history of FS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* First degree</td>
<td>14(53.8%)</td>
<td>12(46.2%)</td>
<td>0.315</td>
<td>0.575</td>
</tr>
<tr>
<td>* Second degree</td>
<td>5(50%)</td>
<td>5(50%)</td>
<td>0.335</td>
<td>0.563</td>
</tr>
</tbody>
</table>
Table (11):
Effect of some variables on the anxiety level score attained by the parents of children under the study (n=115)

<table>
<thead>
<tr>
<th>Variable</th>
<th>Mild</th>
<th>Moderate</th>
<th>Severe</th>
<th>$X^2$</th>
<th>$P$</th>
</tr>
</thead>
<tbody>
<tr>
<td></td>
<td>N (%)</td>
<td>N (%)</td>
<td>N (%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Education level of the informant</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td><strong>Mother</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Illiterate</td>
<td>2(8.3%)</td>
<td>6(25%)</td>
<td>16(66.7%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>*Quaraan &amp; primary school</td>
<td>4(9.8%)</td>
<td>11(26.8%)</td>
<td>26(63.4%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>*Secondary school</td>
<td>3(9.4%)</td>
<td>10(31.3%)</td>
<td>19(59.4%)</td>
<td>-</td>
<td></td>
</tr>
<tr>
<td>*University &amp; postgraduate</td>
<td>-</td>
<td>4(33.3%)</td>
<td>8(66.7%)</td>
<td>1.62</td>
<td>.951</td>
</tr>
<tr>
<td><strong>Father</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Illiterate</td>
<td>-</td>
<td>-</td>
<td>2(100%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Quaraan &amp; primary school</td>
<td>-</td>
<td>1(50%)</td>
<td>1(50%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*Secondary school</td>
<td>-</td>
<td>1(50%)</td>
<td>1(50%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>*University &amp; postgraduate</td>
<td>-</td>
<td>-</td>
<td>-</td>
<td>1.5</td>
<td>0.472</td>
</tr>
<tr>
<td><strong>Type of seizure</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* First seizure</td>
<td>5(6.8%)</td>
<td>18(24.7%)</td>
<td>50(68.5%)</td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Recurrent</td>
<td>4(9.5%)</td>
<td>15(35.7%)</td>
<td>23(54.8%)</td>
<td>2.171</td>
<td>0.338</td>
</tr>
<tr>
<td><strong>Family history of FS</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* First degree</td>
<td>1(3.8%)</td>
<td>8(30.8%)</td>
<td>17(65.4%)</td>
<td>0.75</td>
<td>0.687</td>
</tr>
<tr>
<td>* Second degree</td>
<td>-</td>
<td>2(20%)</td>
<td>8(80%)</td>
<td>1.617</td>
<td>0.446</td>
</tr>
<tr>
<td><strong>Knowledge score</strong></td>
<td></td>
<td></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>* Poor knowledge</td>
<td>5(7.5%)</td>
<td>12(17.9%)</td>
<td>50(74.6%)</td>
<td></td>
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</tr>
<tr>
<td>*Good knowledge</td>
<td>4(8.3%)</td>
<td>21(43.8%)</td>
<td>23(47.9%)</td>
<td>9.677</td>
<td>0.008*</td>
</tr>
</tbody>
</table>

* Significant
Figure (1): Distribution of the study group according to gender
Figure (2): The origin of the children in the study group

Percentage

Central | Northern | Eastern | Western | Southern
14.7    | 33.6     | 0.9     | 41.4    | 9.5
Figure (3): Mothers and Fathers Education
Figure (4): Mothers occupation
Figure (5): Fathers Occupation

Job

Percentage

No Job
Unskilled Labourer
Skilled Labourer
Employee
Professional
Figure (6): First and Recurrent Seizures

- First seizure: 64.70%
- Recurrent seizure: 35.30%
Figure (7): Number of recurrent seizures in patients with recurrence
Figure (8): Type of seizure in recurrent seizure

- 60.3% Complex
- 39.7% Simple
Figure (9): Characteristics of complex febrile seizures
Figure (10): Types of complex seizure in children with recurrence

<table>
<thead>
<tr>
<th>Type</th>
<th>Percentage</th>
</tr>
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<tbody>
<tr>
<td>Focal</td>
<td>8</td>
</tr>
<tr>
<td>&gt;1 in 24hrs</td>
<td>72</td>
</tr>
<tr>
<td>&gt;15 min duration</td>
<td>8</td>
</tr>
<tr>
<td>2 features or more</td>
<td>12</td>
</tr>
</tbody>
</table>
Figure (11): Possible causes of febrile seizures

- Fever: 86.40%
- Evil eye: 6.90%
- Witchcraft: 6.90%
Figure (12): Possible triggering factors of fever to cause FS as mentioned by the parents
Figure (13): Knowledge of possible risks during an attack of seizure

- Aspiration: 26.7%
- Cardiac arrest: 2.6%
- Injuries: 19.8%
- None: 73.3%
Figure (14): Importance of further work-up following an attack of FS

Specific investigation: 32.8%
Neurological follow-up: 49.1%
Figure (15): Options of management

- Antipyretic & treating underlying cause: 67.2%
- Anticonvulsants: 28.5%
- Traditional treatment: 4.3%
Figure (16): Source of information

- Neighbors & Friends: 12.90%
- Medical personnel: 9.50%
- Media: 77.60%
Figure (17): Effects of FS on the child as stated by the parents

- Death: 56.9%
- Paralysis: 71.6%
- Brain damage & mental retardation: 39.7%
- None: 22.4%
Figure (18): Role of traditional treatment

- Traditional treatment: 69.80%
- No place: 30.20%
Figure (19): Attention and care for FS child
Figure (20): Known and performed 1st aid measures during the current seizure

- Lower the child's body temperature: 80.2% Known, 46.6% Performed
- Protect on a safe soft surface: 15.5% Known, 8.6% Performed
- Lay the child on his side: 14.7% Known, 6.9% Performed
- Keep calm: 14.7% Known, 13.3% Performed
- Observe seizure duration & manifestation: 16.4% Known, 11.2% Performed
Figure (21): None recommended practices during the current seizure

- Rush to doctor without 1st aid: 25.9%
- Shack & arouse the convulsing child: 0.8%
- Open mouth & put objects: 5.2%
- Cardiac massage: 0.8%
- Restrain the child: 2.6%
- Too overwhelmed to respond: 35.3%
Figure (22): Immediate effect of the seizure on the parents

- Crying: 71.6%
- GIT symptoms: 48.3%
- Fainting: 1.7%
- Headache, insomnia, & tremors: 25.9%
Figure (23): Knowledge of the parents according to the score

- 59% Good
- 41% Poor
Chapter Four
4- DISCUSSION

Febrile seizures are harmless conditions with an excellent outcome, but is associated with a great deal of anxiety and apprehension by the parents.

It has been extensively studied in other countries regarding risk factors, clinical aspects and psychological impact but only once in our country.

**Socio demographic characterized of the study group:**

The mean age of children in the study was 22.4 months which was comparable to that found by Nelson\(^6\) in his cohort (23.25 months) but lower than that reported by Parmar\(^86\) (27.6 months) and Abdallah\(^92\) (30.3 months).

Male to female ratio 1.5:1 which was similar to that reported previously by Abdallah\(^92\) (1.6:1) but higher than reported between the Indian population by Parmar \(^86\) and American population by Bethune\(^10\) and Swiss population by Flury\(^84\). Our findings, suggests FS might have a slight male preponderance in Sudanese children.

Mean age of mothers in our study was comparable to the mean age of mothers in Huang’s study\(^1\) but lower to that reported by
Verity$^{(61)}$ and Van Suijvenberg$^{(79)}$. Mean age of fathers were comparable between them.

One quarter of the mothers of children in the study were illiterate, which is a high percentage, but much more better than previously mentioned by Abdallah$^{(92)}$ 22 years ago that 77.2% of the mothers were illiterate. Only 12.1% of the fathers were illiterate. Parmar$^{(86)}$ found that 32.8% of his interviewed parents were illiterate. 37.7% of our mothers and 45.7% of our father’s received high education (secondary school or higher education) compared to only 12.9% of the Indian parents$^{(86)}$. This finding might suggest that Sudanese population might have better education than Indian. In Swedish parents$^{(84)}$ 35% had lower education and 55% had higher education level. 57% of Netherlander parents$^{(85)}$ had high education.

**The febrile seizure:**

Two thirds of our study group presented with a first FS which was similar to international studies$^{(6,86)}$, and slightly lower than previously reported by Abdallah$^{(92)}$ in Sudanese children (72.9%).

In comparison to Abdallah’s$^{(92)}$ study we found a lower percentage of children presenting with a simple seizure (97.1 vs 60.3%), but comparable to that found by Verity$^{(61)}$. 
28.4% of children presenting with their first FS had a complex seizure which is equal to the figure reported by the National Collaborative Perinatal Project study\(^{(4,6)}\), but slightly higher than that found by Bethune\(^{(10)}\).

More than half (54.3%) of the complex seizures were recurrences which is lower than that found by Nelson\(^{(6)}\) who reported that three quarters of complex seizures occurred as first seizures and the risk for a complex seizure was approximately the same for the first FS.

**Age of children and FS:**

More than half of the study group (54.3%) were aged 18 month and below, which was similar to Flury’s\(^{(84)}\) finding’s but is higher than what Abdallah\(^{(92)}\) had previously reported among Sudanese population, only 35.7% of his study group were 18 months and below.

We found that more than half of children who presented with recurrences had their seizure within the first year of life. This finding is supported by Berg\(^{(62)}\) who found age of onset is one of the important risks for recurrences. Nelson\(^{(6)}\) in his cohort has found the same percentage. We found also that almost all children with recurrent seizure had their first attack before 2 years of age. Our
percentage is much higher than Flury\textsuperscript{(84)} has found in his study, 62% of children whom he studied had their first FS when below two years of age.

A lower mean age of onset for a FS was found in our study group 16.1 month when compared to the means reported by Nelson\textsuperscript{(6)} (23.25 months) Parmar\textsuperscript{(86)} (27.7 months), Van Esch\textsuperscript{(75)} (20.4 months) and Flury\textsuperscript{(84)} (21.9 months). Our finding agrees to which was previously found in Abdallah’s study\textsuperscript{(92)} that FS has an earlier onset in Sudanese children.

**Risk factors for a first FS:**

In our study using multivariate analysis of risk factors for a first FS and matched case control statistics we found that parental perception of slow development was associated with the highest risk for developing a FS (OR: 11.59, RR 3.94). This is followed by a positive family history of FS in a second degree relative (OR: 7.20, RR 3.33), then a positive family history of FS in a first degree relative (OR 4.04, RR 2.65). Our findings were not similar to those found in Bethune’s study\textsuperscript{(10)} assessing risk factors for a first FS. Bethune’s found that the greatest risk was associated with a positive family history in a first-degree relative (OR : 5.08), followed by neonatal
discharge after 28 days (OR : 4.8), then parental perception of slow development (OR : 4.33), then FS in a second degree relative (OR : 3.86) and lastly day care attendance (OR : 3.13). None of our children were attending a day care attendance nor were discharged from the nursery after 28 days, so these two risk factors couldn’t be assessed.

A positive family history in a second-degree relative and parental perception of slow development seemed to be important risk factors for provoking FS in Sudanese children. Berg\(^{11}\) found height of temperature and history of FS in first or second degree relatives to be important risk factors. Huang\(^{59}\) found FS in the siblings and number of febrile episodes to be important predictors.

One of our findings, which deserve to be mentioned, is that 47.9% of children with recurrent FS had that first seizure before 1 year of age. This is in agreement to that observed by Nelson\(^{6}\) that half of children who have their first FS during the first year of life would have a recurrence and Berg\(^{62}\) in her meta-analytic review found the strongest predictor of recurrent FS is early age of onset.
Knowledge of febrile seizure:

Fever associated seizures was known to almost all (97%) of parents interviewed. Our parents knowledge of FS is much better than Flury\(^{(84)}\) (66%) and Parmar\(^{(86)}\) (77.9%) findings in their studies. This could be explained by Sudan is endemic for malaria and that malaria contributes significantly to the incidence of FS\(^{(90)}\).

Misconceptions about the causes of convulsion were not so prevalent between our study group. 86.2% of the parents related the cause of convulsion directly to fever and only 6.9% directed the cause to evil eye and another 6.9% to witchcraft. Parmar\(^{(86)}\) findings were similar to ours as 91.4% related the cause to high fever, 2.1% to severe cough and 6.5% had no idea of the cause of convulsions. Our results are better than Ofovwe’s study\(^{(90)}\) who found in Nigeria that 71% of urban mothers and only 25% of rural who attributed the cause to fever. The remainder attributed the cause to spiritual causes (evil eye and witchcrafts).

When asking about the underlying causes that provoked fever, 90.5% of the parents couldn’t differentiate simple FS from cerebral malaria (fever, convulsions and loss of consciousness) as they mentioned when malaria ascends to the head it can cause FS as any
other infection. We also found that 10.3% of the parents couldn’t differentiate between FS and encephalitis and meningitis. 25.8% of the parents believed that teething causes fever and thus seizures and when the child erupts all his teeth he wouldn’t be vulnerable to any convulsing episode associated with fever. This can be explained by the peak age for FS coincides to the age of teething and children are usually prone to infection during this age period.

33.6% of our parents considered FS a type of epilepsy. Only 52.6% mentioned it is age dependent and 48.3% believed that the child would certainly have another seizure. Our finding were similar to those of Huang study\(^{(83)}\) among Taiwan parents as he found. 38.4% of parents believing it a type of epilepsy, 71.4% of parents for age dependent and 69.4% for certainly of having another seizure.

Risks during a seizure, as aspiration of vomiting was known by only 26.7%. Our response is better than Parmar\(^{(86)}\) as only 7.1% of Indian parents knew the risk. Ahmed\(^{(91)}\) also found a small percentage (6.3%) of epileptic parents who knew the acute complications of seizure.

About options of management, CT scan, LP and EEG were strongly advocated by 32.8% of the parents. Huang\(^{(1)}\) also found in
his study 85.6% of the parents requested specific investigations. Furthermore, most of the parents strongly advocated anticonvulsants for the management of FS compared to only 33% of our parents.

We were lucky to have only 12% of our parents considering an attack of FS a reason to postpone the immunization schedule. Our results are much more better than Huang (83) who found in his study among Taiwan population that 70.7% of the parents would interrupt the immunization schedule due to FS. This finding reflects the success the immunization program has achieved to illuminate the importance of vaccination.

We observed in our study the very weak role that health institutes, medical personnel and media play to provide health education. The source of information which was gathered from the parents were mainly from neighbors and relatives (77.6%). Medical personnel then media were other sources. Ahmed (91) also found a similar result when assessing KAP between epileptics. Parmar (86) in his study also found that the source of information was from medical personnel in only 19.4%. Neighbors, relatives and a previously affected child were the other sources. These results were far away from Van Suijvenberg (79) study, among Netherlanders, in whom the
main source of information were from health institutes and medical personnel. Others were the source in only 26%.

FS was considered a major life-threatening event in most of our interviewed parents; only 22.4% mentioned it could pass uneventful. Van Suijvenberg\textsuperscript{(79)} study found that 44% of parents mentioned FS is a harmless condition.

There were high concerns between the parents toward their children. Most of the parents voiced out that seizures can cause paralysis, brain damage, mental retardation and death. These assumed consequences might be due to the very traumatizing experience of witnessing a seizure or failure to differentiate FS from intracranial infections which might have similar presentation. Flury\textsuperscript{(84)} found 48% of the parents feared disturbance in the child’s future development.

**Traditional treatment and FS:**

Compared to Ofovwe’s\textsuperscript{(90)} study among Nigerian mothers, traditional treatment was not so prevalent.30.2% of our parents mentioned that there is a role of traditional treatment compared to 92% of urban Nigerian mothers and all of rural Nigerian mothers. This can be partially explained that our study is hospital based and most of
people attending hospital believe in medical treatment and so not all FS cases were brought to hospital for management. Ofovwe’s\textsuperscript{(90)} study was community based and focused group discussion were conducted.

Ahmed\textsuperscript{(91)} in his study assessed management options between epileptics and found only 11.4\% who believed that the Faki would treat them best. Religious rituals were practiced between 26.6\% and Mihaya in 15.2\%. Huang\textsuperscript{(1,83)} found false beliefs and reliance on folk medicine wasn’t prevalent in Taiwan.

Traditional treatment which was mentioned by some of our parents reflects cultural and religious backgrounds. 51.4\% of the traditional treatment options were based on religious rituals like a visit to Al Sheikh, Higab, Mihaya and cutting a rosary. Some of them had hazards to the convulsing child by introducing infection like cauterization and rubbing the body with aster. Some might suffocate the child like using Bakhour. Certainly the child would be in danger of aspiration and injury as when practicing the treatment option no attention would be drawn to the acute risks of seizure. Fortunate enough, none of our children in the study had traditional treatment applied on him.
In Nigeria\(^{(90)}\) most of the constituents of traditional medicine were based on natural environmental substances. Urine (human or cows) was the most frequent used. Leaves, plant and crude oils, fuel and natural soaps were also used. These substances were applied by different routes (orally, topically, rectally or ocular). Some were harmful leading even to suffocation.

**Practices:**

Knowledge and practice of first aid to be applied during the seizure was known by few. Lowering the child’s temperature was the best known and applied. Others were performed by a minority. This was comparable to Huang\(^{(88)}\) findings in his study. Ofovwe\(^{(90)}\) found simple first aid measures were lacking between Nigerian mothers. Non recommended practices were also noticed by Parmar\(^{(86)}\), Flury\(^{(84)}\), Huang\(^{(88)}\) and Rutter\(^{(87)}\) in their studies, such as rushing to the doctor without intervening, forceful opening of the month to introduce objects or drugs, mouth to mouth breathing and restraining the convulsing child. Furthermore, Ofovwe\(^{(90)}\) found putting the child’s feet near the fire to prevent further stretching of the legs and pouring cold water on the convulsing child prevalent among his study group.
Ahmed\(^{(92)}\) also found 31.6% of parents took no reaction during the acute stage of seizure and only 20.3% positioned the child. A considerable percentage would take to the doctor without intervening.

Most of the parents were not involved in the direct immediate management of their children when convulsing. This could be explained by the severe panic state they were in or by the hidden misconception in their mind, which was only voiced out by 26.7% that touching or manipulating the child by the mother causes paralysis or fractures.

**Recognition of the FS:**

The majority of our parents recognized the seizure. Our results are better than in Parmar\(^{(86)}\) study only 40.7% of his parents recognized the seizure, others interpreted the seizure as alteration in sensorium, fainting, shivering or a side effect of a drug.

**Psychological impact of the seizure on the parents:**

The immediate effect of the seizure on the parents was panic and fear. This was similar to the results obtained by Rutter\(^{(87)}\) and Parmar\(^{(86)}\). All mothers in Ofovwe’s\(^{(90)}\) study were in a panic state and
described FS as a near death state. Most of our parents (63.5%) were graded as severe anxiety when assessed by the STAI.

The hypothesis that parents of children with recurrent seizures would attain lower scores on the anxiety scale couldn’t be proved. We found 68.3% of parents of children with a first seizure who had severe anxiety compared to 54.8% of those with recurrences (P: 0.33). The only variable which was significantly associated with low anxiety was high knowledge score (P: 0.08). This was comparable to Flury’s study(84) who found that knowledge of FS was significantly associated with lesser degrees of anxiety in the witnessing parent. Flury(84) also found severity of anxiety to be associated with low educational level, a relation we failed to prove. We found no association between the anxiety level and a positive family history in first or second degree relatives.

Knowledge score:

More than half of the parents studied have poor knowledge about FS according to our score. We assessed the effects of some variables on attaining high knowledge scores: parents educational level, first or recurrent FS and family history of FS in a first or second degree relatives, but non showed a relation. Our findings were not
similar to that obtained in Huang’s study\(^{(1)}\), who found parents of children with recurrent FS having significantly better knowledge than those with a first FS.
CONCLUSION

• There was a slight male preponderance, male to female ratio of 1.5 : 1 and a lower mean age of onset and prevalence for FS among Sudanese children. The ratio between children presenting simple and complex seizures were as international studies but unlike international studies two thirds of complex seizures were recurrences.

• Family history of FS in a second degree relative and parental perception of slow development were found to be the most important predictors for a first FS in Sudanese children. Low age at onset for FS has appeared an important predictor for a recurrent FS.

• Although fever associated seizures were known to almost all of parents, poor knowledge about the nature of FS was prevalent.

• Health education is lacking between our community as simple risks of an acute attack of seizure and first aid to be applied during the seizure were not known.

• Health institutes and workers play a very weak role in providing health education to the community and most of the information were obtained from neighbors and relatives.

• Negative attitudes and high concerns about FS were prevalent and although about one quarter of the parents mentioned traditional treatment as a treatment option they were not so convinced to apply it.
• FS was associated with a great deal of anxiety in the parents which was found to be alleviated by knowledge about FS but not by any other factor like: recurrence, family history of FS or educational level of the parent.

• We found no association between attained knowledge about FS and recurrence, educational level of the parent or family history of FS.
RECOMMENDATIONS

There is a need to know more facts about febrile seizures among Sudanese children, so we recommend conducting prospective studies to:

- Know the actual incidence of FS among our children.
- Identify factors, which predispose our children to lower age of onset and prevalence.
- Identify factors predisposing to recurrent seizures.
- Know the long term outcome of children with FS.

Increase the awareness of the community and especially parents of young children toward FS.

Doctors and other medical personal should give time to parents of children with FS and make it one of their tasks to:

- Allay their fears and address their concerns about recurrences and future outlook of their children.
- Inquire about actions taken by them during the seizure, praise appropriate and discourage harmful ones.
- Inform them about nature of FS and measures to be applied during episodes of fever and seizure attack.
- Incorporating knowledge of febrile seizures in the curriculum of health visitors and nursery schools.
REFERENCES


25. Escayg A, MacDonald BT, Meisler MH. Mutation of SCN1A encoding a neuronal sodium channel in two families with GEFS +. Nat Genet 2000; 24: 343-345


93. قائمة حالة - سمة القلق - تعريف د. أمينة كاظم - دار القلم 1985م - 1405هـ State-Trait Anxiety Inventory
(1) Personal Data:

1- Name: …………………………………………………
Address: …………………………… Telephone No………………

2- Sex:  1) Male   2) Female

3- Age (months)  __________

4- Tribe: ………………………………………………………………………

5- Parents:

5-1. Informant  1) Mother   2) Father   3) Other

5-2. Mother

1) Age (yrs) __________

2) Educational level:  i) Illiterate   ii) Quaraan or primary school
iii) Secondary school level
iv) University and postgraduate

3) Occupation:  i) Housewife   ii) Labourer
iii) Employee   iv) Professional

5-3. Father

1) Age (yrs) __________

2) Educational level:  i) Illiterate   ii) Quaraan or primary school
iii) Secondary school level
iv) University and postgraduate

3) Occupation:  i) No job   ii) Skilled labourer
iii) Employee   iv) Professional
v) Free worker
(2) Febrile Seizure:

2-1. 1) 1st [ ] 2) Recurrent [ ]

2-2. Current seizure: 1) Simple [ ] 2) Focal [ ] 3) > 1 in 24hrs [ ]
4) > 15 min duration [ ]

2-3. Risk factors for a 1st febrile seizure:
1) +ve family history in 1st degree relative [ ]
2) +ve family history in 2nd degree relative [ ]
3) Parental perception of developmental delay [ ]
4) Neonatal discharge after 28 days [ ]
5) Family history of afebrile seizures [ ]
6) None [ ]

In cases of recurrence:
2-4. Age at first presentation (months) [ ]

2-5. Risk factors for recurrence:
1) First seizure occurring before 1yr old. [ ]
2) Low temperature with initial febrile seizure [ ]
3) Family history of afebrile seizure [ ]
4) Family history of febrile seizure in first-degree relative [ ]
5) None [ ]

(3) Knowledge:

3-1. Did you know before of febrile seizures? 1) Yes [ ] 2) No [ ]

3-2. What causes a seizure? 1) Fever [ ] 2) Witchcraft [ ] 3) Evil eye [ ]
4) Underlying abnormality in the brain [ ]
5) Perinatal events [ ]
6) Others, Specify ……………………………………………………

3-3. Is fever important for its occurrence? 1) Yes [ ] 2) No [ ]

3-4. What causes the fever? 1) ARTI [ ] 2) GE [ ] 3) Malaria [ ]
4) Immunization [ ] 5) Meningitis or IC infection [ ]
6) Teething [ ] 7) Others [ ]

3-5. Febrile seizure is: 1) Benign condition [ ] 2) Epilepsy [ ]
3-6. Is it hereditary?  1) Yes  2) No

3-7. Febrile seizure is:  1) Rare after 5 yrs  2) Life long condition

3-8. Every febrile seizure child would certainly have another seizure with a new attack of fever:  1) Yes  2) No

3-9. How long does it last?
   1) Seconds to minutes
   2) Hours

3-10. Febrile seizures remit:
   1) Spontaneously
   2) Only with intervention

3-11. Any risks during the seizure?  1) Aspiration  2) Cardiac arrest
   3) Injuries  4) None

3-12. After a febrile seizure does the child need:
   1) Specific investigation i.e. LP, CT or EEG?  i) Yes  ii) No
   2) Further neurological assessment and follow-up?  i) Yes  ii) No

3-13. Is treating:
   1) The underlying cause of fever and antipyretic enough?  i) Yes  ii) No
   2) The child with anticonvulsants necessary?  i) Yes  ii) No

3-14. Should immunization be postponed?  i) Yes  ii) No

3-15. Source of information:  1) Neighbors, friends or relatives
   2) Media (T.V and radio)
   3) Health institutes & medical personnel

(4) Attitude:

4-1. Febrile seizure develops to epilepsy?  1) Yes  2) No

4-2. Febrile seizure is a life threatening event?  1) Yes  2) No

4-3. Febrile seizure can cause:  1) Death  2) Paralysis
   3) Brain damage & mental retardation
   4) None

4-4. Is there a role for traditional medicine:  1) Yes  2) No

   If Yes specify ………………………………………………………………………..
4-5. Is there any hazard about doing anything during the seizure which increases the risk of complications: 1) Yes □  2) No □
   If Yes specify .................................................................

4-6. More attention and care are needed for a FS child: 1) Yes □  2) No □

4-7. It’s shameful to have a child with FS: 1) Yes □  2) No □

(5) Practice:

5-1. Recommended 1st aid practices:  
   1) Lower the child’s body temperature  ............  ............
   2) Protect on a soft & safe surface  ............  ............
   3) Lay the child on his/her side  ............  ............
   4) Keep calm  ............  ............
   5) Observe seizure manifestation & duration  ............  ............

5-2. Non recommended practices:
   1) Rush the child to doctors without 1st aid
   2) Shake to arouse the convulsing child
   3) Try to open the child’s mouth putting objects
   4) Mouth to mouth resuscitation
   5) Cardiac massage
   6) Restrain the convulsing child
   7) Too overwhelmed to respond

5-3. During the current seizure:
   1) Recognized the convulsion: 1) Yes □  2) No □
      If No thoughts at that time ...........................................
   2) Immediate effect of the convulsion on the parent?
      i) Cry
      ii) Faint
      iii) GIT symptoms
      iv) Others ............................................................
### STATE TRAIT ANXIETY INVENTORY (STAI) 
#### Self Evaluation Questionnaire

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<th>Item</th>
<th>Description</th>
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<tr>
<td>1</td>
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<td>2</td>
<td>أشعر آمني آمن ..</td>
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<td>3</td>
<td>أني متوتر ..</td>
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<td>4</td>
<td>أني نادم (أسف) ..</td>
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<td>5</td>
<td>أشعر آني براحتي ..</td>
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<td>6</td>
<td>أشعر آني معكس المزاج ..</td>
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<td>7</td>
<td>باني مشغول بما قد أصابه من سوء حظ ..</td>
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<td>8</td>
<td>أشعر آني مستكتن (مستقر) ..</td>
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<td>9</td>
<td>أشعر بالقلق ..</td>
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<td>10</td>
<td>أشعر باني مرتاح ..</td>
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<td>11</td>
<td>أشعر آني واقع من نفسي ..</td>
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<td>أشعر بالزعزعة (عدم الثقة) ..</td>
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<td>17</td>
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<td>18</td>
<td>أشعر آني بالغ الاستثارة والاهتزاز ..</td>
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<tr>
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<td>أشعر بالسرور ..</td>
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#### General Grade of the Total Scale 
- درجة شديدة جدا
- درجة شديدة
- درجة متوسطة
- إلى حد ما
- أبدا
مفتاح تصحيح قائمة حالة القلق

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