Leukocyte Count and Erythrocyte Sedimentation Rate as Diagnostic Factors in Febrile Convulsion

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Abstract- Febrile convulsion (FC) is the most common seizure disorder in childhood. white blood cell (WBC) and erythrocyte sedimentation rate (ESR) are commonly measured in FC. Trauma, vomiting and bleeding can also lead to WBC and ESR so the blood tests must carefully be interpreted by the clinician. In this cross sectional study 410 children(163 with FC), aged 6 months to 5 years, admitted to Bahrami Children hospital in the first 48 hours of their febrile disease, either with or without seizure, were evaluated over an 18 months period. Age, sex, temperature; history of vomiting, bleeding or trauma; WBC, ESR and hemoglobin were recorded in all children. There was a significant increase of WBC (P<0.001) in children with FC so we can deduct that leukocytosis encountered in children with FC can be due to convulsion in itself. There was no significant difference regarding ESR (P=0.113) between the two groups. In fact, elevated ESR is a result of underlying pathology. In stable patients who don't have any indication of lumbar puncture, there's no need to assess WBC and ESR as an indicator of underlying infection. If the patient is transferred to pediatric ward and still there's no reason to suspect a bacterial infection, there is no need for WBC test.

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Introduction

Febrile convulsion (FC) is the most common seizure disorder occurring in childhood, especially in those aged 6-24 months (1).In large population-based studies, the prevalence of FC has been estimated to be 2-5% (2,3).

Simple febrile convulsion is defined as a generalized tonic-clonic seizure, usually lasting less than 15 minutes, which occurs only once during a febrile illness. It is not associated with infection of central nervous system (CNS) or a metabolic disorder. The great majority of FCs are medically benign. Almost one third of the children will have recurrent seizures in future and two-thirds present with simple manifestations (4). When FC attack proceeds for more than 15 minutes, recur within 24 hours or show focal signs, a more serious condition might be present which is called complex FC (3,5).

A febrile convulsion could be a response to invasion of the blood stream or central nervous system by a micro-organism which is usually a virus. Invasion may be of such brief duration that successful isolation of the virus from the blood, CSF, or urine is not commonly achieved (6). Viral infections play a role in the etiology of FC by more than one possible mechanism: fever per se; a degree of fever that exceeds the individual threshold convulsive temperature and an elevated level of cytokines (7). Human Herpes Virus 6, Herpes Simplex Virus and Influenza Virus A, B are mentioned by many text books as being the leading cause of FC. Bacterial infections are much less indicated as the underlying etiology of FC (2,4).

In most cases, the source of infection is easily found by a meticulous history taking and physical examination. However, clinicians don't share the same view about using paraclinic data as the diagnostic criteria for FC. Several diagnostic guidelines have been designated to approach FC in children. The main issue in all of them is to find the

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possible source of infection and to rule out metabolic or CNS disorders.

White blood cell (WBC) and erythrocyte sedimentation rate (ESR) are measured in all complicated febrile children. American Academy of Pediatrics considers blood test as a way of finding the infectious source of fever, not a routine procedure for evaluating FC (8,9).

Situations such as fever, trauma, vomiting, dehydration, bleeding and metabolic disorders can lead to changes in leukocyte count and ESR level. The two indices are elevated as a result of epinephrine release and demargination of neutrophils; so, the above blood tests must carefully be interpreted by the clinician.

As these two tests are done routinely for all cases of FC in Bahrami Children Hospital (Tehran, Iran) this cross sectional study aims to compare WBC and ESR in febrile children, aged 6 months to five years, with and without FC, in order to determine whether leukocytosis and elevated ESR can be used as diagnostic tests in children with FC.

Materials and Methods

This is a cross sectional study of children admitted to emergency department of Bahrami children hospital because of their febrile disease, either with or without seizure, over an 18 months period from March 2005 to September 2006.

All children included in the study were 6 months to 5 years old. They all attended emergency ward of Bahrami Hospital in the first 48 hours of their febrile disease. None of them had taken antibiotics before admission. Fever was defined as having an axillary temperature more than 37.3˚C at the time of admission. Those diagnosed as having a FC attack, fulfilled the criteria for simple FC: the seizure occurred in the first 48 hours of the febrile disease, it didn't last more than 15 minutes and the seizure was a generalized type without any focal sign.

Some variables such as age, sex, temperature, presence or history of vomiting, bleeding, trauma and levels of WBC, ESR and hemoglobin were recorded in all febrile patients. Other paraclinic tests such as chest x-ray, blood culture, urine analysis and culture, stool exam and culture and lumbar puncture were carried out if needed.

The patients who were not in the age group mentioned above and those who were febrile for more than 48 hours, who had taken antibiotics during or before admission to hospital and who had any abnormality in their urine, stool, cerebrospinal fluid and blood culture were excluded from the study. Those with an attack of seizure who had any finding indicating CNS infection were also excluded from the study.

We should emphasize that all the necessary diagnostic and therapeutic interventions were performed for all patients, even if it led to being excluded from the study.

To analyze the data, we used t-test for comparing quantitative data and chi square test for qualitative data.

Results

A total of 410 children(184 girls and 226 boys),aged 6 months to 5 years(mean age 21.5 ± 13.54 months) were included in the study; 163 of which were diagnosed as having an attack of FC. The youngest study participant was 6 months and the eldest was 70 months old. None of the children had a history of trauma or bleeding. The mean temperature was 38.3˚C,the lowest degree of fever was 37.5 and the highest 40˚C.

The other findings are summarized in table 1.

When comparing FC and non-FC children, we encountered a significant increase of WBC (P =0.0005) in children with FC.WBC count was not associated with the body temperature of the patients , measured at the time of admission to emergency ward (P=0.23).

Table 1. Characteristics of febrile children

Sex	Children with FC	children without FC
Boys	89 (54/6%)	137 (55/5%)
Girls	137 (55/5%)	110 (44/5%)
Mean age (months)	20.7 ± 14.1	22.7 ± 12.6
Positive history of vomiting	49 (30/1%)	231 (93/5%)
Positive history of bleeding	-	-
Positive history of trauma	-	-
WBC (Mean)	9187 ± 3598	10898 ± 4926
ESR (Mean)	15.47 ± 12.75	14.20 ±11.99
Hb (mg/dlit)	11.81 ± 1.065	11.99 ± 1.065

There was no significant difference regarding ESR (P=0.66) and hemoglobin (P=0.345) between the two groups.

None of the children, either with or without FC, had a history of trauma or bleeding. On the other hand, the majority of non-FC patients had a history of vomiting. This led to a statistically significant difference between the two groups regarding history of vomiting (χ^2=182.63, P =0.0003).

Discussion

In this cross sectional study we compared leukocyte count and ESR level in febrile children with and without FC attending emergency department of Bahrami Hospital (Tehran, Iran) during 18 months period. No significant difference was observed among the two groups regarding ESR level but a statistically significant difference was observed in leukocyte count.

In two observational studies performed in Iran (10) and the Netherlands (11), the researchers agreed that elevated WBC in FC cases is due to the underlying infection, not a result of convulsion as a stressor. Warden et al have recommended routine WBC assessment for children with FC in their systematic review about febrile seizure (12).On the other hand, Effects of electrically induced convulsion (EIC) in rabbits on peripheral leukocyte-count levels were studied in Japan. Leukocyte-counts increased immediately after the EIC (phase-1) and 4 hours later (phase-2) (13). American Academy of Pediatrics does not recommend the routine tests of complete blood count, serum electrolytes and plasma glucose for children with FC (9).

In our cross sectional study, the FC patients were encountered with an additional stressor: seizure. Since WBC level was significantly higher in children with FC, we can deduct that leukocytosis can be due to the stress of convulsion, not just an indicator of underlying infection.

Several factors such as trauma, bleeding, vomiting and dehydration can confound our results. Some of these factors are taken into account: none of the children had a previous history of trauma and bleeding and vomiting was more encountered in non-FC patients whose leukocyte count was significantly lower than the FC group. However we didn't directly assess dehydration and metabolic disorders as the possible causes of leukocytosis. Authors suggest that these two and other possible confounding factors be compared in FC and non-FC children in future studies.

According to Mc Carthy, the evaluation of an ambulatory, febrile child with acute-phase reactants should include at least determination of ESR since high ESR demonstrated the best balance of specificity and sensitivity for bacteremia (14).

In our study, the same reasoning can't be applied to ESR because there was no significant difference among the two groups (P>0.05). In fact, elevated ESR is a result of underlying infection. In conclusion, as 80-85% of FC cases are of simple FC type and viral infections are the leading underlying cause, authors recommend the following procedures for children with febrile seizure attending emergency departments:

In stable patients who don't have any indication of lumbar puncture, there's no need to assess WBC and ESR as an indicator of underlying infection. If the patient is transferred to pediatric ward and still there's no reason to suspect a bacterial infection, there is no need for WBC test.

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