CSF Glucose Concentrations in Infants with Febrile Convulsions and the Possible Effect of Acetaminophen

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The present study was done to explore the relationship between the cerebrospinal fluid (CSF) glucose concentration, body temperature, seizure duration, and acetaminophen administration. Retrospective record review of 117 consecutive febrile convulsive infants aging 3 to 18 months admitted to Bahrami Children Hospital were studied. There was a positive correlation between CSF glucose level and body temperature in those who had not taken acetaminophen before admission (r = 0.515, P<0.001, n = 83). CSF glucose levels were significantly higher (P = 0.014) in febrile children (75.33 mg/dL, n =70) as compared with afebrile children (66.16 mg/dL, n = 13). In those administered acetaminophen there was a negative correlation between the CSF glucose level and body temperature (r =– 0.389, P = 0.023, n = 34). CSF glucose concentration was not significantly different (P = 0.076) in those who had taken acetaminophen than those who had not taken. Type of febrile seizure, fever, convulsion duration and multiplicity were not significantly correlated with CSF glucose concentration.

Key words: *Acetaminophen, CSF glucose, Febrile seizure.*

Hyperglycemia and hyperglycorrhagia are common associations of febrile seizures(1,2). Rapid release of cortisol and adrenaline after seizures as a stress reaction induces elevated glucose concentration in blood and CSF(1). Fever intensity is also independently correlated with elevated CSF glucose level following febrile seizures(3).

The effect of acetaminophen administration on CSF glucose concentration is unclear. The present study was done to evaluate the relation of fever and convulsion with CSF glucose concentration and to evaluate any effect of acetaminophen administration on CSF glucose concentration.

Subjects and Methods

The records of 128 patients aged 3-18 months admitted with febrile convulsions from March 1998 to January 2001 were studied retrospectively. All patients were subjected to a diagnostic lumbar puncture. A detailed history including preadmission acetaminophen administration was recorded. Patients with CSF pleocytosis, positive CSF culture, recent head trauma, metabolic disorders and epilepsy were excluded (n = 11). The children were assigned to Group I (n = 83) if they had not taken acetaminophen during the 6 hours before the convulsion and Group II (n = 34) if they had received acetaminophen. Children were considered febrile if the axillary temperature was higher than 37.2ºC(4). None of the patients had received any other medication in the previous 24 hours.

A simple febrile seizure was defined as a single generalized convulsion lasting less than 15 minutes in a febrile infant. Febrile seizures were defined as complex if they did not fulfill the above criteria(5).

CSF samples were obtained on an average of 3 hours after the first convulsion. Glucose concentration in the blood and CSF was determined by o-toluidine method. The aldehyde portion of glucose gets condensed with o-toluidine and the resulting complex is measured with a spectrophotometer (Spectronic 20D, Milton Roy Company, Belgium)(6).

Correlation between the quantitative variables was analyzed by Spearman's correlation analysis. Comaprisons between the mean CSF glucose concentrations in the febrile and afebrile, and simple and complex febrile seizures were performed using Student's t-test. The same method was used to compare the mean CSF glucose concentrations in different groups based on sex, duration of fever, multiplicity of convulsive attacks, and acetaminophen administration. A P-value of <0.05 was considered statistically significant.

Results

Group I consisted of 83 children who were not administered acetaminophen during 6 hours before convulsion. In this group 70 children were febrile at the time of admission while 13 gave a history of fever at the time of convulsion but were afebrile at admission. In this group the mean CSF glucose concentration was significantly higher in febrile as compared to afebrile children (75.32 ± 2.94 mg/dL *vs* 66.15 ± 6.20 mg/dL; P = 0.014.

There was a linear correlation between CSF glucose concentration and body temperature in children who had not taken acetaminophen before admission (r = 0.515, P <0.001).

However a negative correlation (r = –0.389, P = 0.023) was found between the CSF glucose concentation and body temperature in those who had taken acetaminophen before admission (Group II; n = 34). The mean CSF glucose concentration was somewhat higher in Group II (78.68 mg/dL, n = 34), than Group I (73.89 mg/dL, n = 83) but the difference was not statistically significant (P = 0.076).

There was no statistically significant difference between CSF glucose concentration in the simple and complex febrile seizure groups and also between convulsive attacks longer than 15 minutes and shorter attacks. There was no statistically significant difference (73.53 mg/dL *vs* 75.79 mg/dL; P = 0.415) betwee the CSF glucose concentation of those with multiple convulsions (n = 32) compared to those with a single seizure (n = 84).

The duration of fever had a negative correlation (r = –0.175, P = 0.08) with CSF glucose concentration (n = 101). As expected, there was a linear correlation between the glucose concentrations in the blood and CSF (r = 0.244, P = 0.012) in 105 patients in whom the data was available. The mean CSF glucose concentration was not significantly different (77.38 mg/dL *vs* 73.00 mg/dL; P = 0.07) in boys (n = 61) and girls (n = 56).

Discussion

Glucose enters the CSF by a facilitated transport system located in the choroid plexus(7,8). CSF glucose concentration has previously been shown to be directly proportional to that of blood(1,9). Our study reaffirms this correlation. The results show that in febrile and convulsive cases the CSF glucose concentration is increased, but we were not able to elucidate the role of each individual factor.

Hyperglycemia is regarded as a consequence of convulsion-induced release of both cortisol and adrenaline(1). Interleukin 1

Key Messages

- CSF glucose concentration is increased in febrile and convulsive children who are not administered acetaminophen.
- The possible role of acetaminophen in changing the CSF glucose levels should be further investigated.

beta (IL-1), an endogenous pyrogenic cytokine, inhibits insulin release(10,11) and stimulates the secretion of cortisol(11,12). This may explain the correlation between CSF glucose concentration and body temperature in the present report. Significant difference in mean CSF glucose concentrations in the convulsive infants presenting with and without fever may also be explained by IL-1 and its effects.

Our results show a negative correlation between the CSF glucose levels and body temperature in the patients administered acetaminophen prior to admission. This may be due to the non-specific o-toluidine method used for determination of CSF glucose. Additionally, acetaminophen preparation might have changed blood or CSF glucose levels. Alternatively, acetaminophen may be more effective in lowering temperature in children with higher CSF glucose levels.

Prospective studies to evaluate the effect of acetaminophen on the blood and CSF glucose concentration are warranted.

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Efficacy of Twice Weekly Iron Supplementation in Anemic Adolescent Girls

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Two hundred and forty four girls with different hemoglobin levels were selected, of which forty-one were non-anemic. The rest were graded as mildly, moderately or severely anemic and supplemented with 60 mg of iron daily or twice weekly for twelve weeks. There was no significant difference in the increase in hemoglobin levels between daily and twice weekly-supplemented subjects at the end of the study. Unpleasant side effects of supplementation were experienced by 57.8% of the daily supplemented subjects as against 5.9% of twice weekly-supplemented ones. Twice weekly supplementation could be recommended for overcoming anemia in adolescent girls.

Key words: *Adolescent girls, Anemia, Iron supplementation, Hemoglobin.*

Iron deficiency anemia is the most prevalent micronutrient deficiency among humans all over the world. Among Indians, FAO and WHO, 1993(1) reported an incidence of iron deficiency in 65% of adult women, 45% of adult men and 77% of children under five. The percentage of Indian adolescent girls who were anemic was reported as 73.7% by Chaturvedi, *et al*.(2) and 61.9% in urban areas and 85.4% in rural areas(3).

Adolescent girls are a particularly vulnerable group as their requirements of iron as well as its losses from the body are high. Anemia during adolescence limits growth and delays the onset of menarche, which in turn may later lead to cephalopelvic disproportion(4). Very often, in India, girls get married and pregnant even before the growth period is over, making anemia doubly risky. Few programes for anemia control have targeted adolescent girls and health care of adolescent girls all over the world has not been given priority(4). Since the anemic status of these adolescent girls is bound to affect their offspring, care during this period is likely to pay rich dividends.