Convulsions and Shigellosis

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Abstract

The records of 97 children with culture-proven Shigellosis were reviewed in order to assess the frequency and risk factors of convulsions associated with this infection. Thirteen (13.4%) had convulsions, three of whom had additional features suggestive of encephalopathy. Clinical and laboratory data were compared between patients with and without convulsions to define the risk factors for the development of seizures. A high peak temperature and high band forms in excess of 10% of the differential white cell count were significant risk factors. Age, sex, family history of febrile seizure or epilepsy, and the Shigella strain were not significant risk factors.

Keywords: Shigellosis; Convulsion

Introduction

Convulsion is among the most frequent extra-intestinal manifestations of Shigellosis. It occurs in 12 to 45% of affected children,[1-4] which is more frequent than other common febrile illness. The pathogenesis of such neurological manifestations is not clear. It has been suggested that the factors related to the course of disease like high fever and electrolyte disturbances[5] and the production of neurotoxin by the Shigella organism may play a role.[6] The aim of this retrospective study was to review the clinical and laboratory features of children with Shigellosis and to identify the risk factors for the development of convulsions.

Subjects and methods

We reviewed the records of 97 children with culture-proven Shigellosis, who were admitted into the University Paediatric Unit of Queen Mary Hospital between January 1987 and December 1992. The medical history, clinical and laboratory data were analysed and compared between children with and without convulsions. Statistical analysis were performed using the Students' t test and chi-square test.

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Results

Thirteen (13.4%) of the 97 children with culture-proven Shigella gastroenteritis presented with generalized tonic-clonic convulsions within 24 hours of onset of fever. Five of these patients did not have any diarrhoeal symptoms before admission. The convulsions all lasted for less than 15 minutes. Two had another attack of convulsion (less than 15 minutes) after admission. Three (3%) of them had drowsiness and stupor on presentation. None had clinical signs of meningitis. Lumbar puncture was performed in six patients (three with encephalopathy, two with recurrent convulsions and one who was seven years old which fell outside the age range for febrile convulsion) and the cerebrospinal fluid (CSF) findings were normal. Cultures of the CSF were all sterile. Computerised tomography scanning of the brain was performed in the three patients with encephalopathy and changes of cerebral oedema was only present in one of them. Electroencephalogram showed diffuse slow waves changes in all three patients. They were started empirically on intravenous Acyclovir and Cefotaxime for suspected infectious encephalopathy. Acyclovir and Cefotaxime were stopped when the stool culture results were available. One seven-year-old child developed myocarditis and heart failure in addition to encephalopathy. The encephalopathic changes resolved within 24 hours after admission. All the other patients had a benign course and recovered uneventfully after treatment.

The age distribution of the children with or without convulsions is shown in Figure 1. Of the 60 children under five years of age, eight (13.3%) had convulsion as compared to five (13.5%) of 37 children over five years of age.

The history, clinical and laboratory data were

Table 1. Possible Risk factors for convulsions in 97 children with Shigellosis

Factor	Children with convulsions	Children without convulsions	p
Number	13	84	
Age (years)	4.39 ± 2.97*	4.57 ± 3.54	NS
Family history of convulsions (%)	0	0	NS
Individual history of febrile convulsions	2	0	NS
M:F ratio	2.25:1	1.27:1	NS
Temperature peak (°C)	39.9 ± 0.7	38.6 ± 1.1	< 0.0001
White cell count (10^9/L)	15.8 ± 6.3	14.1 ± 8.0	NS
Band form > 10% (%)	100	32	< 0.0001
Serum sodium (mmol/l)	135.8 ± 3.6	136.6 ± 4.3	NS
Serum potassium (mmol/l)	3.6 ± 0.3	3.7 ± 0.5	NS
pH	7.38 ± 0.05	7.38 ± 0.06	NS

* mean ± SD
NS = not significant (p > 0.05)

compared between children with and without convulsions for possible risk factors (Table 1). No difference was found between the two groups with respect to age, family history of febrile convulsion or epilepsy, sex ratio, total leucocyte count, serum electrolytes and pH. The mean temperature peak was significantly higher in children with convulsions than in those without (39.9 ± 0.7°C vs 38.6 ± 1.1°C, p < 0.0001). Among those with convulsion, only one had a temperature below 39°C. Six (46.2%) had a temperature between 39.1 to 40°C while six (46.2%) had temperature above 40°C. Children with convulsions had a significantly higher percentage of band forms in their differential white cell counts (28.8 ± 10.4%, p < 0.0001).

In the study population, 69 (71%), 27 (28%) and 1 (1%) were infected by Shigella flexneri, Shigella sonnei and Shigella dysenteriae respectively. Among those with convulsions, seven were infected by Shigella flexneri and six by Shigella sonnei. There was no statistical significance among the different strains of Shigella on the occurrence of convulsions (Table 2).

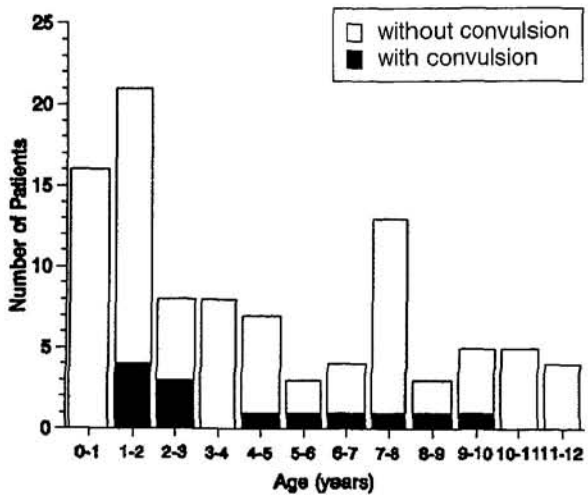

Fig. 1. The age distribution of patients with or without convulsions.

Discussion

Neurological symptoms are the commonest extra-intestinal manifestations of Shigellosis. In our series, 13.4% of the patients had convulsions and 3% had encephalopathy. This is lower than the prevalence of 12 to 45% reported in other series.[1-4] Since not all the patients with Shigellosis are hospitalized, the true incidence of neurological symptoms may be lower.

Young age, a history of convulsions in the patient or family, and a high peak temperature were risk factors that were associated with higher incidence of convulsions in Ashkenazi's series.[4] Other factors like the serum electrolytes, blood glucose, the total white cell counts, the absolute number of band cells, and the species of Shigella were not important risk factors. We identified only two factors that were associated with higher risk of convulsions: a high peak temperature and a high band forms of greater than 10% of the differential white cell count. 92.4% patients with convulsions had a temperature of higher than 39°C. All of our patients with convulsions had greater than 10% of band forms in their differential

Table 2. Influence of Shigella strain on occurrence of convulsions

Shigella strain	No of children infected	No.(%) of children with convulsions	p
Shigella flexneri	69	7 (10%)	NS
Shigella sonnei	27	6 (22%)	NS
Shigella dysenteriae	1	0 (0%)	NS

white cell count. The high band forms may be an acute stress response to the convulsion or the infection itself, as a result of epinephrine-mediated reactions and mobilization of the immature neutrophils into the circulation. Young age was not an important risk factor in our series. 13.3% of children under five years and 13.5% of children over five years of age developed convulsions associated with Shigella infection. In fact, 41.7% of those having convulsions were older than five years of age, which fell outside the usual age range for febrile convulsions, with the oldest one being nine years old. A family history of convulsions has not been found to be a significant risk factor in our patients.

Seizure occurs more frequently in Shigellosis than in other gastrointestinal infections. The underlying reason is unclear. It has been attributed to the Shiga toxin which possesses neurotoxic, cytotoxic and enterotoxic properties but its exact role remains controversial.[7] Although Shiga toxin is considered to be a neurotoxin, it does not directly invade neurons, but damages the endothelial cells, causing vascular disturbances in the brain with secondary neurological disturbances. Recently Ashkenazi et al. found a heat-labile cytotoxin with a molecular mass of 100 to 125 kDa produced by pathogenic Shigella species, caused reversible neurological dysfunction in experimental mice.[8] Whether other toxic products of Shigella organisms play a role in the pathogenesis of neurological manifestation still needs further studies.

In summary, while the pathogenesis of Shigellosis-associated convulsions is still unclear, a high peak temperature and high band forms in excess of 10% of the differential leucocyte count were significant risk factors for the development of seizures in Shigellosis.

References

1. Ashkenazi S, Dinari G, Zevulunov A, et al. Convulsions in childhood shigellosis : clinical and laboratory features in 153 children. Am J Dis Child 1987; 141: 208–10.
2. Avital A, Maayan C, Goitein KJ. Incidence of convulsions and encephalopathy in childhood shigella infections. Clin Pediatr 1987; 21: 645–8.
3. Donald WD, Winkler CH, Bargeron LM Jr. The occurrence of convulsions in shigella gastroenteritis. J Pediatr 1956; 48: 323–7.
4. Ashkenazi S, Dinari G, Weitz R, et al. Convulsions in shigellosis : evaluation of possible risk factors. Am J Dis Child 1983; 137: 985–7.
5. Keusch GT. Shigella infections. Clin Gastroenterol 1979; 8: 645–61.
6. Levine MM. Bacterial dysentery : mechanisms and treatment. Med Clin North Am 1982; 66: 623–38.
7. Bartlett AV III, Prado D, Cleary TG, et al. Production of shiga toxin and other cytotoxins by serogroups of shigella. J Infect Dis 1986; 154: 996–1002.
8. Ashkenazi S, Cleary KR, Pickering LK, et al. The association of shiga toxin and other cytotoxins with the neurologic manifestations of shigellosis. J Infect Dis 1990; 161: 961–5.