DS (Child) H J 2021; 37(1): 45-50

ORIGINAL ARTICLE

Influence of Febrile Seizure in Children's Neurodevelopment

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Abstract

Background*: Febrile seizure is one of the most common diseases in early childhood. The impact of early-life Febrile Seizure on the developing brain is an important issue to detect.*

Objectives: *To observe the neurodevelopment of children suffering from different types of febrile seizures.*

Methods*: This was a prospective observational study; the study was conducted in Dhaka Shishu (Children) Hospital, Dhaka from July 2012 to August 2013. Total 71 children were included in the study who fulfilled the selection criteria. History was taken thoroughly. Rapid neurodevelopmental assessment (RNDA) was performed for initial assessment and subsequent follow up and was advised accordingly.*

Results*: Total 71 cases were included where mean age was 17.76±8.03 months, median was 16 months; in both the group male child had slight high preponderance. Majority of seizures were <10 minutes duration in both group which was not statistically significant. Important postictal event was found, 12 cases (26.7%) in simple seizure and 16 cases (61.5%) in complex seizures which was found statistically significant, but there was no risk for further seizure. On follow up, RNDA detected risk of impairment in vision, cognition, speech and behavior. In complex group statistically significant association was found with impairment of cognition only at initial and follow up at 3 month.*

Conclusion*: Neurodevelopment impairment is not influenced by types of febrile seizure but significant cognitive impairment was found in complex seizure.*

Keywords*: Febrile seizure, neurodevelopment, Rapid neurodevelopmental assessment (RNDA).*

Introduction

Febrile seizure (FS) is the most common seizure disorder in childhood.[1,2] Incidence of febrile seizure is approximately 2% to 5%.[3-5] Febrile seizures are classified as either simple or complex. Although epidemiological studies have made substantial contributions to our understanding of the frequency, natural history and seizure recurrence, there are critical issues that remain unanswered. The impact of early-life FS on the developing brain has not been

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Received: 04 April 2021; **Accepted**: 30 May 2021

fully resolved.[6] Numerous authors consider the prognosis of febrile convulsions to be favorable, and assume that parents who are frequently extremely worried require reassurance about the outcome.[7] It was previously emphasized that febrile convulsions are benign events.[8,9] Different studies were also carried out as follow up studies into the intellectual performance of children with febrile convulsions. All of those studies have considerable methodological deficits that is lack of controls, performance of only one neuropsychological test, application of non-standardized test procedures, and too-small patient groups, so that no real conclusions could be drawn regarding mental performance of children following febrile convulsions.[10-13]

Although many studies have been done on this issue but total neurodevelopmental assessment and its association with FS is not seen. In this study an effort has been tried to detect the influence of FS on children's neurodevelopment by using RNDA. The standardized tools used in western settings are too specialized and require levels of skills and resources rarely found in low and middle-income settings. The RNDA is reliable and valid for identifying specific neurodevelopmental impairments including autism spectrum disorders, and when linked to appropriate interventions.[14] So this study was done to see the neurodevelopmental outcome of children suffering from different types of febrile seizures

Materials and Methods

This study was conducted at Dhaka Shishu (Children) Hospital, Sher-e-Bangla Nagar, Dhaka. Study was conducted from July 2012 to August 2013. The children suffering from different types of febrile seizure from 5 months - 5 years, fulfilling the inclusion criteria were selected as sample. Hospital admitted children with febrile seizure (Age 5 months to 5 years) were included in the study. The child with cerebral palsy and other developmental delay, known case of neurological disease (trauma, tumor, and neurodegenerative), meningitis or seizures due to CNS infection (encephalitis, abscess) were excluded. A pre-tested questionnaire was administered, Rapid Neuro-developmental assessment kits were used as research instruments. Reassurance was given to parents as there was no harmful effect for babies or economic loss. Clearance was taken from the ethical committee. Children with suspected febrile seizures were admitted in the inpatient department of Dhaka Shishu (Children) Hospital. After admission into the hospital, cases were consecutively screened and subsequently enrolled considering the inclusion and exclusion criteria. The parents or legal guardians of the children eligible to enter the study were fully informed about the aims and objectives of the study and there after consent of the parent was taken. Detailed clinical history and thorough physical examination was performed. Relevant information were taken to differentiate the types of febrile seizure, seizure semiology (Age of onset of febrile seizure, nature of seizure generalized or focal, duration of seizure, frequency of seizure, immediate postictal events- drowsiness, unconsciousness, weakness of any part of the body, abnormal behavior). Rapid neurodevelopmental assessment was done at discharge and after 3 months.

Result

Total 71 cases of febrile seizures were included in this study to determine the predictors of neurodevelopmental outcome of febrile seizures 63.4% were in simple and 36.6% were in complex seizures group (Fig.-1).

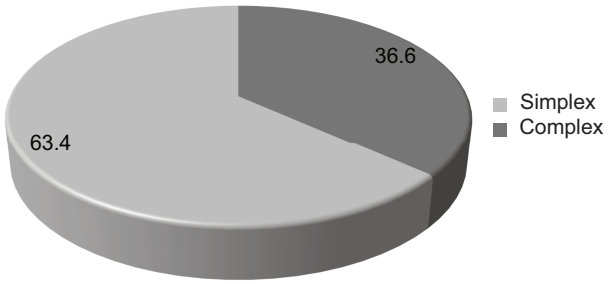

Fig.-1 *Distribution of types of febrile seizure*

Patients' characteristics on admission showed male child was 70.4% and female was 29.6%. When age distribution was observed it was seen that less than 1 year was 35.2%, more than 1 year was 64.8%. Consanguinity was present in 8% cases. Most of the children came from poor socioeconomic background. Positive family history was found in 25.35% cases (Table I).

Table I
Patient's characteristics at admission (n=71)

		Frequency	Percentage
Sex	Male	50	70.4
	Female	21	29.6
Age	<12 months	26	35.2
	>12months	45	64.8
Consanguinity	Present	6	8.5
	Absent	65	91.5
Socioeconomic status	Average	22	31
	Below average	49	69
Family history	Positive	18	25.35
	Negative	53	74.65

In different febrile seizures, seizure semiology was different. Positive family history of febrile seizure was more in simple febrile seizure group (61.1%) and in complex seizure group it was 38.9%. Duration of seizure more than 10 minutes was seen in simple febrile seizure group which was found in 66.7% cases. Degree of fever was not associated with types of seizure. 31.6% of complex seizure group and 68.4% of simple seizure group had high grade fever. Postictal event was more in complex febrile seizure group (59.3%) and p value was <0.05 (Table II).

Neurodevelopmental assessment was observed by RNDA. No significant association was found in febrile seizure when we observed gross motor, fine motor, vision, hearing and language. In cognition it was seen that in initial assessment 42.3% children in complex group had cognitive impairment which was statistically significant. When behavior was observed it was seen that 65.4% had impairment in complex group and 86.5 % had impairment in simple group which was not significant (Table III and IV).

Table II
Association between seizure semiology with simple versus complex

		Complex	Simple	p value	OR
Family history	Positive	7(38.9%)	11(61.1%)	1	0.878(0.292-2.642)
	Negative	19(35.8%)	34(64.2%)		
Duration of Seizure	<10min	23(37.1%)	39(62.9%)	1	1.17(0.269-5.174)
	>10 min	3(33.3%)	6(66.7%)		
Degree of Fever	High	18(31.6%)	39(68.4%)	0.12	0.346(0.105-1.146)
	Low	8(57.1%)	6(42.9%)		
Immediate post Ictal event *	Yes	16(59.3%)	11(40.77%)	**0.003	0.202(0.071-0.573)
	No	10(22.73%)	34(77.3%)		

Table III
Initial neurodevelopmental assessment

		Yes	No	p value	OR with 95% CI
Gross motor	Complex	3(11.5%)	23(88.5%)	0.136	5.739(0.565-58.32)
	Simple	1(2.2%)	44(97.8%)		
Fine motor	Complex	6(23.1%)	20(76.9%)	0.194	0.652(0.829-1.802)
	Simple	5(11.1%)	40(88.9%)		
Vision	Complex	2(7.7%)	24(92.3%)	0.5	3.67(0.316-42.55)
	Simple	1(2.2%)	44(97.8%)		
Hearing	Complex	2(7.7%)	24(92.3%)	1	0.854(0.145-5.017)
	Simple	4(8.9%)	41(91.1%)		
Cognition	Complex	11(42.3%)	15(57.7%)	.05	2.993(1.009-8.528)
	Simple	9(20%)	36(80%)		
Expressive language	Complex	9(34.6%)	17(65.40%)	0.278	1.853(0.635-5.407)
	Simple	10(22.2%)	35(77.7%)		
Behavior	Complex	17(65.4%)	9(34.6%)	0.06	0.291(.089-0.945)
	Simple	39(86.7%)	6(13.3%)		

Table IV
Follow up neurodevelopmental assessment (after 3 Months)

		Yes	No	p value	OR with 95% CI
Gross motor	Complex	1(3.8%)	25(96.2%)	1	1.76(0.105- 29.378)
	Simple	1(2.2%)	44(97.8%)		
Fine motor	Complex	4(15.4%)	22(84.6%)	0.182	3.909(0.664-23.038)
	Simple	2(4.4%)	43(95.6%)		
Vision	Complex	3(11.5)	23(88.5%)	0.348	2.804(0.437-18.005)
	Simple	2(4.6%)	43(95.6%)		
Hearing	Complex	1(3.8%)	25(96.2%)	1	0.86(0.074-9.971)
	Simple	2(4.4%)	43(95.6%)		
Cognition	Complex	8(30.8%)	18(69.2%)	0.05	3.556(1.021-12.387)
	Simple	5(11.1%)	36(88.9%)		
Expressive language	Complex	5(19.2%)	21(88.8%)	1	1.01(0.319-3.802)
	Simple	8(17.8%)	37(82.2%)		

Discussion

Febrile seizure is a benign and common childhood illness. Lots of studies were done on febrile seizure including socio-demographic characteristics, clinical profiles, but the neurodevelopmental assessment were assessed in few studies. In this study among the total samples of febrile seizures 45 cases (63.4%) had simple febrile seizures & 26 cases (36.6%) had complex febrile seizures. The result of our observation was similar to that of Ghasen et al[15] in which simple febrile seizure was 99(61.9%) & complex febrile seizure was 61 cases (38.1%). Another study showed 55% of febrile convulsions were simple and 45 % complex, which almost corresponds to our study.[16] Falah et al[17] found one third of the patient and Al-Zwaini et al[18] found 27% complex febrile seizure in their study.[18]

Among the admitted patients with febrile seizures common age in >12 months. In another study the majority of children were under 2 years of age, they found febrile seizure was in the age range of 6 months to 3 years, with peak incidence at the of age, of 18 months.[21] Our findings were similar to other study, febrile seizures are slightly more common in males.[22] It was found that prevalence of febrile convulsion was slightly predominant in males than females and this was similar with the results of other studies done.[23,24] In our study positive family history was found in 11 (24.4%) cases in simple seizures and 7(26.9%) in complex seizure. In another study had positive family history of febrile convulsion, with the percentage varied from 25% to 40%.[24] Seizure semiology is the description of a seizure. Seizures are usually generalized tonic-clonic, hypotonic, or clonic, short-lasting, and had mild postictal manifestations.[2] Seizure duration, showed majority seizures were <10 min, among them 86.7% was simple and 88.5% was in complex group which was not statistically significant but having risk of further seizures. In a study the majority of patients (78%) had seizure duration less than or equal to 15 minutes.[15]

In 39 (86.7%) cases of simple seizure developed during high fever and 18 (69.2%) cases of complex seizure developed during high grade temperature, which was not statistically significant. The mean rectal temperature during convulsion was 38.3°C ranging from 38-40°C.[15]

Important postictal event was found 12(26.7%) in simple seizure and 16(61.5%) in complex seizures which was found statistically significant (p value<.05), but no risk for further seizure. Seizures may produce mild post-ictal manifestations.[26] It is an important finding which needs further evaluation. Another study showed that the key factors for recurrence are early age at first seizure, family history of febrile

seizures, temperature and duration of febrile illness (the shorter the febrile period, the higher the odds of recurrence).[15]

Neurodevelopmental assessment by RNDA showed important findings in cognition, 42.3% developed impairment in complex and 20% in simple group. If we consider in behavior 65.4% impairment occurred in complex group and 86.7% occurred in simple group. In expressive language, 34.6% impairment occurred in complex group and 22.20% occurred in simple group. There was no association of complex and febrile seizures with cognition, behavior and speech. But there was risk of developing impairment of cognition and speech in complex seizures. Neurodevelopmental impairment in motor and tone ($p<.05$) was observed in a study by Pedespan et al.[22]

At 3 months follow up impairments and disabilities of different domain showed maximum moderate impairment in cognition and behavior and maximum mild impairment in expressive language. No association have been seen in impairment of gross motor and fine motor, vision, hearing and speech with complex and simple febrile seizures. No association of complex and febrile seizures with behavior and speech were found.

Pedespan et al[22] found following febrile convulsion cognitive and motor performance of the subject with febrile convulsion achieved fewer good results which were statistically significant in arithmetic abilities.[22]

Ying-chao et al[28] found that there is subtle neurocognitive dysfunction in school-age children having previous febrile convulsion, although the global outcome is favorable.[28]

Some follow up studies into the intellectual performance of children with febrile convulsions showed similar findings with our study.[28-31] Behavioral abnormalities were exhibited by 22% of the patients and 6% of the healthy children. The neuropsychological test results did not demonstrate significant differences between the children with febrile convulsions and the healthy controls. Non-verbal intelligence was found to be significantly lower as compared with children with simple febrile seizures and with controls.[32]

Conclusion

Febrile seizure is a common disease in early childhood which was due to its benign natural history does not create significant attention to follow up the children further. Repeated assessment the children who developed impairment in different domain had overcome the problem in early recognition & stimulation. Neurodevelopmental impairment is not influenced by types of febrile seizure but risk has been detected in different developmental domain in the study population.

Recommendation

A larger scale population and long-term follow-up study is needed to delineate the pattern of neurodevelopmental impairment their associated risk factors among FS children. Significant association has been found between complex seizure and postictal illness which needs further research.

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