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RESEARCH ARTICLE

Neuropsychological Deficits in Children with Epilepsy: A Study Using Luria Nebraska Neuropsychological Battery- Children's Revision

M. Thomas Kishore[1], S. Haque Nizamie[2], Masroor Jahan[3], Alka Nizamie[4] and Dharmendra Kumar Singh[5]

ABSTRACT

Neuropsychological deficits are common in epilepsy, which would put the children with epilepsy at double disadvantage due to the deficits and the condition itself. Though neuropsychological assessment is advocated for planing interventions, lack of indigenous tools make this task complicated. Therefore, with the aim of studying neuropsychological deficits in children with epilepsy using LNNB children's revision (LNNB-C), 25 children with epilepsy and 25 with normal controls aged 8-14 years were selected through purposive sampling technique. The result revealed that LNNB-C could significantly differentiate epileptic children from normal controls (Fisher Exact Test $=6.35$; $df = 48$; $p < .01$). Epileptic children differed from the normal controls in integrative functions, spatial based movements, motor speed and word and phrase repetition. However, there was no significant difference in visual functions, writing, reading and memory. These findings indicate that epileptic children exhibit wide range of neuropsychological deficits and LNNB-C can be used for neuropsychological assessment in the Indian context. In the light of these findings comprehensive neuropsychological assessment is more desirable over IQ assessment in epilepsy.

Keywords: *neuropsychological deficits, children, epilepsy and LNNB.*

INTRODUCTION

Epilepsy is a symptom of ictal and interictal brain dysfunction. Thus, possibility that neuropsychological impairment may develop as secondary symptom is obvious (Aldencamp, 1997). Though there are differences in findings regarding the nature of deficits in epilepsy, many studies concluded that epileptic patients perform poorer than the normal controls (Klove & Mathew, 1996; Gülgönen et al., 2000; Jahan et al., 2000). The deficits are likely to have differential effects with respect to the age group. In childhood, they are likely to affect the learning and academics, putting the pediatric patients at double disadvantage due to negative effects of epilepsy and associated cognitive deficits (Bailet & Trunk, 2000; Rao, 1993; Rao et al., 1992; Long & Moore, 1979; Stores, 1978; Pazzalia & Frank-Pazzalia, 1976; Stores & Hart, 1976). Therefore, to initiate appropriate interventions and to monitor treatment response, a thorough neuropsychological assessment is often advised.

In the past emphasis was only on intelligence as it was considered equivalent to cognition. With advances in understanding of cognition and emergence of neuropsychological batteries there has been a shift in assessment from applying intelligence tests to neuropsychological tests and batteries (Dodrill, 1978). However, problem with the individual test is that it may not be measuring what it purports to measure. Thus some authors advised using neuropsychological batteries with slight modification of instruction to suit the individual's cultural milieu (Dodrill, 1992; Bennet, 1992; Jahan et al., 2000). Such an approach will have an advantage of providing comprehensive information, as there have been unequivocal evidences that a wide range of deficits involving intelligence, memory, attention, motor and mental speed and pereceptuo-motor functioning occur in children with epilepsy, which may effect the overall functioning of children (Farewill et al., 1985; Rao, 1993; Bailet & Turk, 2000). In Indian setting, lack of indigenous neuropsychological tool always makes the task complicated. Since the Luria Nebraska Neuropsychological Battery (LNNB; Golden et al., 1982) has been found to be useful in adult epileptic population in several studies, particularly in India (Berg & Golden, 1981; Jahan et al., 2000; Mishra et al., 2002). LNNB-C is a downward extension of the adult version, hence, LNNB-C was used in the present study

1. *Assistant Professor of Clinical Psychology, NIMH Regional Centre, Kolkata. (Reprint Request).*
2. *Director & Professor of Psychiatry, Central Institute of Psychiatry, Ranchi.*
3. *Assistant Professor of Clinical Psychology, Ranchi Institute of Neuro-Psychiatry & Allied Sciences, Ranchi.*
4. *Associate Professor of Clinical Psychology & Director (Academics), Deepsikha ICD & MH, Ranchi.*
5. *Ph.D. Scholar (Clinical Psychology), Ranchi Institute of Neuro-Psychiatry & Allied Sciences, Ranchi.*

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to assess the neuropsychological deficits in epileptic children.

METHOD

Sample:

This preliminary study included 25 children with epilepsy, diagnosed by a consulting psychiatrist and/or a neurologist as per the Commission on Classification and Terminology of the International League Against Epilepsy (1981, 1989), in the age range of 8-14 years from English medium schools were included in the study through purposive sampling. A group of 25 normal children in the same age range were also included through purposive sampling. History revealing psychoses, epilepsy secondary to head injury and neuroinfectious diseases, mental retardation or developmental delay prior to the onset of epilepsy and unwillingness to participate in the study were the exclusion criteria. Minimum of class-II education was compulsory for children in both groups. Informed verbal consent of guardian of selected subjects was taken.

Tools:

LNNB-C was designed to measure various neuropsychological deficits in children aged 8-14 years (Golden, 1987). It contains 149 items spread across 11 clinical scales, 3 summary scales and factor scales. For interpretation, T scores of the clinical scales and S1 (Pathognomic) scale scores would be compared with the individual's critical level. In general, elevation of three or more scales above the critical level is considered to be indicative of brain damage.

Procedure:

After selection of subjects, clinical details, developmental and school history were obtained from parents. LNNB-C was administered with adequate intervals keeping the motivational and attention factors of the child in view.

Statistical Analysis:

Analysis was done with Statistical Package for Social Sciences (SPSS for Windows Ver. 11.0). Descriptive statistics (percentages and mean) were used to describe demographic and clinical details of the participants. Klomogrov-Smirnov Z test was applied to see the distribution of age and education. Since frequency in individual cell was less, to assess the group difference, Fisher Exact Test was applied for the dichotomous variables including the gender, socioeconomic status, clinical scales, factor scales, summary scales and LNNB-C criteria for brain damage. Canonical discriminant analysis was used for item analysis.

RESULTS

Among the epileptic children 7 had primary generalized tonic-clonic seizures, and rest had simple and complex partial seizures evolving to generalized seizures. Klomogrov-Smirnov Z test suggested that age and education were normally distributed. Mean age of children with epilepsy and normal controls was 11.2 (± 1.89) and 10.04 (± 1.43) years respectively, which was significant ($t = 20$; $df = 48$; $p = .02$). Significant differences ($t = 2.56$; $df = 48$; $p = .01$) were observed in the education of epileptic children (5.32 ± 2.56 years) and normal controls (3.72 ± 1.79 years). In both the groups majority were males, right handed and from middle socioeconomic status (Table 1).

Table 1: Showing demographic characteristicsof the sample

Varibales		Group		Value of Fisher Exact Test	p-value
		Epilespy	Normal		
Gender	Male	20	24		
	Female	5	1	3.02	.19
Socioeconomic status	Middle	22	25		
	High	3	0	3.19	.24
Handed ness	Right	24	24		
	Left	1	1	.0	1.0

The LNNB-C profile shows that 11 patients (44%) and three normal controls (12%) met the criteria for brain damage ($\div^2 = 6.35$; $df = 48$; $p = .01$). S1 scale could significantly differentiate between the epileptic children and normal controls ($\div^2 = 7.02$; $df = 48$; $p = .008$). Clinical scales revealed epileptic children had problems predominantly in writing (40%), rhythm (36%), expressive speech (36%), motor functions (32%) and receptive speech (32%). Normal controls showed problems (12% each) in rhythm perception, reading and arithmetic. However, there were no significant differences in visual functions, writing, reading and memory (Table 2).

On factor scales, significant differences were observed in integrative functions, spatial based movements, motor speed and word and phrase repetition (Table 3). Item analysis revealed that children with epilepsy showed wide range of deficits related to frontal, parietal and temporal lobe (Table 4).

Table 2: Showing group differences on clinical and S1 scales

LNNB-C scales	Epilepsy n (%)	Normals n (%)	Value of Fisher Exact Test	p-value
LNNB-C criteria for brain damage	11 (44%)	3 (12%)	6.35	.01
C1 (motor functions)	8 (32%)	0	9.52	.002
C2 (rhythm)	9 (36%)	3 (12%)	3.95	.05
C3 (tactile functions)	4 (16%)	0	4.35	.04
C4 (visual functions)	3 (12%)	1 (4%)	1.09	.61
C5 (receptive speech)	8 (302%)	2 (8%)	4.50	.03
C6 (expressive speech)	9 (36%)	1 (4%)	8	.005
C7 (writing)	10 (40%)	8 (32%)	.34	.56
C8 (reading)	4 (16%)	3 (121%)	.17	.68
C9 (arithmetic)	10 (40%)	3 (12%)	5.09	.02
C10 (memory)	4 (16%)	2 (8%)	.76	.38
C11 (intellectual functioning)	7 (28%)	2 (8%)	3.39	.07
S1 (pathognomic)	10 (40%)	2 (8%)	7.02	.008

[a]LNNB-C criteria of three or more scales above the critical level.

Table 3 : Showing group differences on factor scales

LNNB-C scales	Epilepsy n (%)	Normals n (%)	Value of Fisher Exact Test	p-value
F 1 (academic achievement)	12 (48%)	8 (32%)	1.33	.25
F 2 (integrative functions)	9 (36%)	1 (4%)	8.00	.01
F 3 (spatial-based movements)	7 (28%)	0	8.14	.01
F 4 (motor speed movement)	8 (32%)	1 (4%)	6.64	.02
F 5 (drawing quality)	1 (4%)	0	1.02	1.0
F 6 (drawing speed)	1 (4%)	0	1.02	1.0
F 7 (rhythm perception & production)	11 (44%)	7 (28%)	1.39	.38
F 8 (tactile sensations)	2 (8%)	2 (8%)	0	1.0
F 9 (receptive language)	6 (24%)	4 (16%)	.50	.73
F 10 (expressive language)	8 (32%)	6 (24%)	.39	.75
F 11 (word and phrase repetition)	9 (36%)	1 (4%)	8.0	.01

Table 4 : Showing deficit in functions and corresponding lobe

Items	Functions	Lobe
1, 2, 3	Simple movemnets	Posterior frontal lobe
11, 12, 13, 14	Motor movements with some spatial organization	Bilateral frontal lobe
15, 16, 17	Complex movements	Motor area and prefrontal lobe
33, 34	Speech regulation of motor movements	Either of hemisphere
42	Production of series of rhythms on verbal commands	Either of hemisphere
43, 49, 50, 54, 55, 56	Cutaneous sensations	Anterior parietal lobe
78, 79, 82, 83	Comprehending complex instructions and performance	Predominantly left hemisphere
96, 97, 98, 100, 103, 104	Reading simple sounds, syllables and words	Temporal and parietal lobes of left hemisphere
121, 124, 125, 127	Writing and manipulation of numbers	Right hemisphere or left occipito-parietal functions

DISCUSSION

This study demonstrated that children with epilepsy exhibit wide range of neuropsychological deficits. Consistent with earlier studies LNNB-C criteria of brain damage and S1 (Pathognomic) scale were useful in differentiating the epileptic children from normal controls (Golden, 1991). In this study 11 epileptic children (44%) and 3 normal children (12%) were identified as brain damaged on LNNB-C. Interestingly, the qualitative analysis of LNNB-C profiles of the normal children meeting the brain damage criteria revealed academic history of specific learning disabilities. These evidence further strengths the efficacy of LNNB-C in identifying the neuropsychological deficits that would impede learning.

Further analysis revealed that epileptic children showed problems in the areas sensitive to attention and concentration, tactile and motor functions and language suggestive of minimal frontal lobe dysfunction (Rao et al., 2000). Therefore, considering the relevance of these functions in daily living, remedial procedures should focus these areas too.

Earlier studies has proposed that it would be desirable to do item analysis in addition to analyzing the scales to understand what kind of deficits characterize particular condition (Golden, 1991). In the present study, an analysis of items revealed that simple and complex movements with spatial organization, speech regulation of motor movements, production of series of rhythm on verbal command, cutaneous sensations, reading and writing were seriously affected. These findings are consistent with the earlier studies (Jahan et al., 2000; Bailet & Turk, 2000).

Even the normal children showed problems in the areas of reading, writing and arithmetic, which highlight the need for a careful analysis of LNNB-C protocol before suspecting brain damage. Secondly, mere elevation of these scales should not be taken as an indicator of brain damage.

Although the current findings are important and highly relevant, a few limitations of this study needs consideration before generalizing the findings, which include lack of local norms of LNNB-C, and lack of equal representation for each type, frequency and duration of epilepsy. Future studies can focus on analyzing the neuropsychological deficits in relation to these seizure-related variables. Despite limitationa, it can be concluded that children with epilepsy would show multiple neuropsychological deficits irrespective of their intellectual functioning.

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