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AN PROSPECTIVE CASE CONTROL STUDY ON IDENTIFY THE NEUROBEHAVIORAL PROFILE AND THE IMPACT ON CHILDREN WITH EPILEPSY

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ABSTRACT

Background: The primary goal of managing epilepsy is to control seizures, and the key to a successful course of therapy is to reduce the frequency of seizures. Neurobehavioral issues are very common. Therefore, screening and intervention are necessary. Finding the neurobehavioral profile and its effects on kids with epilepsy was the goal. **Materials and Methods:** From September 2025 to February 2026, 100 consecutive school-age children aged 4 to 17 with normal IQ who attended the epilepsy ward at KMCH, Katihar, Bihar, were enrolled as cases, and 102 children of the same age, gender, and socioeconomic class who did not have epilepsy were selected as controls. Both groups are given the strengths and challenges questionnaire. In addition to the fifth dimension of prosocial behavior, it covers five domains: emotional, conduct, hyperactivity, and peer issues, all of which add to the overall challenges score. **Result:** 41% of the children with epilepsy had emotional problems, 67% had conduct problems, 54% had hyperactivity behavior, 64% had peer problems, and only 27% had pro-social behavior. The total difficulty score was 60%, which was statistically significant with p<0.001 in all domains when compared to the control. The disease had a 73% impact on the home environment, a 67% impact on classroom learning, a 45% impact on leisure activities, a 10% impact on friendship, and a statistically significant p<0.001 in all categories when compared to the control. **Conclusion:** Children with epilepsy have been found to be significantly impacted by emotional, behavioral, hyperactive, and peer issues. Therefore, screening across a range of behavioral domains aids in the early detection and timely treatment of neurobehavior.

INTRODUCTION

Epilepsy is a chronic disorder characterized by recurrent seizures. The prevalence of epilepsy in Indian children is 5.59 per 1000 population.[1] Children with epilepsy (CWE) are at increased risk of neurological, psychological and physical comorbidities.[2] The reported prevalence of psychiatric disorder is 50-60% and behavioural comorbidity is 43%.[3,4] There are different scales available for behavioural assessment in children. Strength & difficulty questionnaire (SDQ) is a free, brief and easy to administer screening questionnaire available for behavioural assessment for 4–17-year age group. The SDQ has good psychometric properties in varied cultures and languages and demonstrated use in Indian studies.[4-6] Developed countries have reported high frequency of behavioural problems in CWE.[7,8] Differences in etiology, treatment protocols and social factors may modify the frequency of behavioural problems in different settings.

MATERIALS AND METHODS

This Prospective case control questionnaire based observational study was conducted at epilepsy ward of Katihar Medical College and Hospital, Katihar, Bihar from September 2025 to February 2026. 100 consecutive school-age children aged 4 to 17 with normal IQ who attended the epilepsy ward at KMCH, Katihar, Bihar, were enrolled as cases, and 102 children of the same age, gender, and socioeconomic class who did not have epilepsy were selected as controls.

All successive children and adolescents with normal IQs who were diagnosed with epilepsy and admitted to the epilepsy ward were included. The following are the requirements for inclusion: children between the ages of 4 and 17 who have had epilepsy for at least six months. For regular health examinations and immunizations, controls were chosen from the pediatric outpatient department.

Both groups did not include children with neurodevelopmental difficulties such as autism spectrum disorders, cerebral palsy, mental illness, or other chronic conditions.

There is variation in the prevalence of behavioral comorbidity in children with epilepsy; some have rates as high as 53%. We determined that a sample size of 96 patients would be necessary to attain an expected prevalence of 50% behavioral comorbidity in our study, with a 95% confidence level and a±0.10 width of confidence (CI).

In this study, we followed accepted definitions of epilepsy, epilepsy control, drug-resistant epilepsy, school dropout, and irregular attendance.

Every patient had their IQ evaluated using the Vineland Social Maturity Scale (VSMS), and those who scored higher than 70 were admitted. The Strength and Difficulties Questionnaire (SDQ), a linguistically suitable questionnaire, was given to all cases and controls in order to test for neurobehavioral problems. Five domains—hyperactivity, emotional, conduct, peer problem, and prosocial behavior—were included in the SDQ parent's version. It used overall problems, individual symptom ratings, and total impact scores to assess children for neurobehavioral disorders. Scores from all four domains—aside from the prosocial domain—were added up to create a total problems score. A total difficulty score of 0–13 was regarded as almost ordinary, 14–16 as significantly higher, 17–19 as high, and 20–40 as extremely high. The effects of neurobehavioral issues on home life, peer relationships, classroom learning, leisure activities, and general distress were evaluated using an additional supplement. The scale's sensitivity and specificity were 95% and 35%, respectively, and its internal consistency was 0.73. Its test-retest reliability was 0.62. The information gathered in this way is completely private and anonymous.

Data were analysed using SPSS software version 24.0. All categorical data were presented using frequency and percentages, and all continuous data were described using mean±SD or Median and interquartile range based on the distribution. The baseline demographics, clinical, and developmental parameters were compared by Epilepsy status and SDQ using the Chi-square test or Fisher’s exact test based on the expected frequency. The p value was considered significant at 5% level of significance.

RESULTS

Children with epilepsy (cases) and children without epilepsy (control) have mean±SD ages of 8.97±3.82 and 9.3±3.55, respectively, with male to female ratios of 1.5:1 and 1.2:1. In both categories, the majority of youngsters come from lower socioeconomic classes (Modified Kuppuswamy scale). The two groups match in terms of age, gender, and SES.

Table 1: Distribution of cases and control based on gender

Gender	Groups, No. (%)		Total	P value
	Epilepsy	Control		
Female	39 (39.0%)	46 (45.1%)	85 (42.1%)	0.38
Male	61 (61.0%)	56 (54.9%)	117(57.9%)	
Total	100(100%)	102 (100%)	202(100%)	

Table 2:Age wise distribution

Age (years)	Groups, No. (%)		Total	P value
	Epilepsy	Control		
≤10	63 (63.0%)	62 (60.7%)	125 (61.8%)	0.746
11-18	37 (37.0%)	40 (39.2%)	77 (38.1%)	
Total	100(100%)	102(100%)	202 (100%)	

In comparison to children without epilepsy, whose percentages were 7%, 1%, and 5%, respectively (p<0.001), children with epilepsy exhibit irregular school attendance (30%), learning difficulties (24%), and behavioral problems (21%). Five percent of students drop out of school, compared to none in the control group.

Table 3: The behavioural profile in various domains using the SDQ questionnaire

Group	Emotional Symptom				Conduct				Hyperactive				Peer Problem				Pro Social			
	VH	H	SR	CA	VH	H	SR	CA	VH	H	SR	CA	VH	H	SR	CA	CA	SL	L	VL
Epilepsy	9	14	18	59	21	29	17	33	28	8	18	46	33	21	10	36	26	21	27	23
Control	1	12	16	73	4	5	23	70	7	3	16	76	7	16	19	60	49	32	12	3

*VH=Very High, H=High, SR=Slightly Raised, CA=Close to Average, SL=Slightly Low, L=Low, VL=Very Low

It was shown that 34% are receiving polytherapy and 66% are receiving monotherapy. 18.2% of kids receiving monotherapy and 61.8% of kids receiving polytherapy achieved extremely high scores. Levetiracetam is the most often used medication (71%), followed by sodium valproate (17%). 36%

had poor seizure control, whereas 64% showed seizure control. Fifteen percent of cases have drug resistance. In comparison to children on monotherapy, well-controlled, and drug-responsive cases, children on polytherapy, those with uncontrolled seizures, and drug-resistant cases showed substantial behavioral alterations (p<0.001). Children with focal seizures and those with generalized seizures do not significantly differ in the overall difficulty score.

Of the children with epilepsy, 33% had very high scores, 15% had high scores, 12% had somewhat elevated scores, and 40% had close to average levels. 68.6% of children without epilepsy had scores that were near to average, 15.7% had somewhat higher scores, 7.8% had high scores, and 7.8% had extremely high scores. With p<0.001, this difference is statistically significant. Table 2 displays the behavioral profiles in each of the individual domains. In each of the individual domains, the p value was significant.

Among the children with epilepsy (group 1) in our study, there were 39 (39%) females and 61 (61%) males; in the control group (group 2), there were 46 (45.1%) females and 56 (54.9%) boys. Male to female ratios were 1.56:1 in cases and 1.21:1 in controls. There was no statistically significant difference in the proportions (p=0.38).

Table 4: Distribution based on socioeconomic status

SES Status	Group No. (%)		Total	p-value
	Epilepsy	Control		
Lower upper	74(74%)	71(69.6%)	145(71.8%)	0.786
Middle lower	21(21%)	25(24.5%)	46(22.8%)	
Upper middle	5(5%)	6(5.9%)	11(5.4%)	
Total	100(100%)	102(100%)	102(100%)	

Table 5: Distribution based on the behavioural problems seen in children with epilepsy compared to children without epilepsy based on history

Behaviour problem	Groups, No. (%)		Total	P value
	Epilepsy	Control		
Yes	21 (21.0%)	5 (4.9%)	26 (12.9%)	0.001
No	79 (79.0%)	97 (95.1%)	176 (87.1%)	
Total	100(100.0%)	102 (100.0%)	202 (100.0%)	

Table 6: The classification of epilepsy based on the etiology

Etiological Classification	SDQ TDS No. (%)				Total	p-value
	Very High	High	Slightly Raised	Close to average		
Electroclinical syndrome	20(30.8%)	10(15.4%)	8(12.3%)	27(41.5%)	65(100%)	0.714
Structural epilepsy	9(31.0%)	4(13.8%)	4(13.8%)	12(41.4%)	29(100%)	
Unknown epilepsy	0	1(50%)	0	1(50%)	2(100%)	
Immune-mediated	2(100%)	0	0	0	2(100%)	
Infection	2(100%)	0	0	0	2(100%)	
Total	33(33%)	15(15%)	12(12%)	40(40%)	100(100%)	

Based on age group, further separated into two groups: adolescents (ages 11–18) and those under 10. Of those under ten, sixty-three (63%) had epilepsy and sixty-two (60.7%) did not.

There were 40 (39.2%) non-epileptics and 37 (37%) epileptics in the adolescent group. The p-value, which is not significant, was 0.746. According to modified Kuppuswamy's classification, the majority of patients in both groups belonged to lower upper socioeconomic grade because our study was carried out in a tertiary referral government hospital. Age distribution, gender, and socioeconomic structure were found to be similar in our study sample of 100 cases and 102 controls, meaning that the cases and controls were from the same cohort. In all of the aforementioned cases, the p value was not statistically significant. Based on the aetiology, epilepsy was further categorized. Electroclinical syndrome accounted for the bulk of cases, with structural-metabolic syndrome coming in second. The p value of 0.714 suggests there was no significant difference in the SDQ score among various types of epilepsy.

The impact received a score of 0 for not at all and a little, 1 for quite a lot, and 2 for a great deal. The sum of the five domains was used to determine the overall impact score. The influence in different areas between cases and control is displayed in [Table 2].

Table 7: Comparison between the subscale of SDQ in CWE compared to children without epilepsy

Domains		Children with epilepsy (n=100)	Children without epilepsy (n=102)	P value
SDQ TDS	Very high	33 (33.0%)	8 (7.8%)	<0.001
	High	15 (15.0%)	8 (7.8%)	
	Slightly raised	12 (12.0%)	16 (15.7%)	
	Close to average	40 (40.0%)	70 (68.6%)	
Emotional symptom	Very high	9 (9.0%)	1 (1.0%)	

	High	14 (14.0%)	12 (11.8%)	0.043
	Slightly raised	18 (18.0%)	16 (15.7%)	
	Close to average	59 (59.0%)	73 (71.6%)	
Conduct	Very high	21 (21.0%)	4 (3.9%)	<0.001
	High	29 (29.0%)	5 (4.9%)	
	Slightly raised	17 (17.0%)	23 (22.5%)	
	Close to average	33 (33.0%)	70 (68.6%)	
Hyperactive	Very high	28 (28.0%)	7 (6.9%)	<0.001
	High	8(8.0%)	3 (2.9%)	
	Slightly raised	18 (18.0%)	16 (15.7%)	
	Close to average	46 (46.0%)	76 (74.5%)	
Peerproblem	Very high	33 (33.0%)	7 (6.9%)	<0.001
	High	21 (21.0%)	16 (15.7%)	
	Slightly raised	10 (10.0%)	19 (18.6%)	
	Close to average	36 (36.0%)	60 (58.8%)	
Pro-social	Close to average	26 (26.0%)	49 (48.0%)	<0.001
	Slightly lower	21 (21.0%)	38 (37.2%)	
	Low	28 (28.0%)	12 (11.8%)	
	Very low	25 (25.0%)	3 (2.9%)	

Table 8: Showing the impact on various areas of life in CWE compared to children without epilepsy

Variables		**Children with epilepsy (n=100)**	**Children without epilepsy (n=102)**	**P value**
Upset/distress child	Great deal	9 (9.0%)	0 (0.0%)	<0.001
	Medium amount	14 (14.0%)	1 (1.0%)	
	A little	63 (63.0%)	0 (0.0%)	
	Not at all	14 (14.0%)	101 (99.0%)	
Home life	Great deal	28 (28.0%)	0 (0.0%)	<0.001
	Medium amount	39 (39.0%)	6 (5.9%)	
	A little	27 (27.0%)	0 (0.0%)	
	Not at all	6 (6.0%)	96 (94.1%)	
Friendship/peer relations	Great deal	10 (10.0%)	0 (0.0%)	<0.001
	Medium amount	21 (21.0%)	2 (2.0%)	
	A little	48 (48.0%)	0 (0.0%)	
	Not at all	21 (21.0%)	100 (98.0%)	
Classroom learning	Great deal	23 (23.0%)	0 (0.0%)	<0.001
	Medium amount	22 (22.0%)	3 (2.9%)	
	A little	43 (43.0%)	0 (0.0%)	
	Not at all	12 (12.0%)	99 (97.1%)	
Leisure activity	Great deal	5 (5.0%)	0 (0.0%)	<0.001
	Medium amount	23 (23.0%)	0 (0.0%)	
	A little	41 (41.0%)	0 (0.0%)	
	Not at all	31 (31.0%)	102 (100.0%)	
Total impact score	Very high	38 (38.0%)	0 (0.0%)	<0.001
	High	16 (16.0%)	12 (11.7%)	
	Slightly raised	19 (19.0%)	0 (0.0%)	
	Close to average	27 (27.0%)	90 (88.23%)	

DISCUSSION

According to this study, 48% of children with epilepsy and 16% of children without the condition had neurobehavioral issues.

According to Indian data from Mumbai, Maharashtra, the frequency was 7.9% among normal children and 39.1% among CWE.[9,10] A hospital-based study from Southern India found a significantly higher incidence of psychopathology of 53.8%, whereas Choudhary et al. from Delhi reported a frequency of 43%.[11-13] 23% have emotional symptoms, 50% have conduct issues, 36% have hyperactive behavior, 54% have peer issues, and 53% have decreased pro-social behavior. Anita et al. found that 38% of participants had emotional problems, 32% had conduct issues, 44% had hyperactive behavior, 38% had peer issues, and 15% had decreased pro-social behavior. In addition to their peer difficulties connected to epilepsy, the current cohort's increased frequency of peer problems decreased prosocial behavior, which may be explained by their lack of education and socialization during the pandemic. Second, the stigma associated with the illness may potentially be responsible for the disruption of family and child routines and decreased socializing. When compared to children without epilepsy, children with epilepsy are significantly more affected by neurobehavioral issues. Home life (28%), classroom learning (23%), disturbed children (9%), friendships/peer relationships (10%), and leisure activities (5%) are all observed to be impacted. In every domain, the p value is substantial ($p<0.001$). Beyond the diagnosis and severity of epilepsy, the SDQ questionnaire assists in determining the individual's needs. Treatment approaches for epilepsy still concentrate on the clinical components, but holistic care must address social as well as clinical symptoms. The hyperactive behavior score and conduct problem score are added together to determine the externalizing score. The emotional and peer problem scores were added together to determine the internalizing score. The externalizing disorder is more frequently seen in this study than the internalizing condition. According to a study by Mishra et al., younger children frequently exhibit externalizing behavior, while later age groups exhibit both internalizing and externalizing behavior. Internalizing disorder is more frequently seen than externalizing disorder, according to a study by Anita et al. The majority of participants in the current study are under 10 years old, whereas the majority in their study are teenagers. Using SDQ as the measurement method, we have examined six investigations. Each of these investigations, which used SDQ and were carried out in reputable tertiary care teaching institutions with sample sizes ranging from 47 to 222, has intrinsic strengths and weaknesses in the way the results are presented.

Only two studies discuss consistent, unambiguous findings. In CWE, behavioral issues range in frequency from 11% to 48%. While our study shows lower scores for emotional problems and Gandhi et al. indicate fewer hyperactive problems, the results highlight emotional, conduct, peer relationship, and hyperactivity problems in CWE. The children in the sample, the usage of SDQ-P or SDQ-S, the participants' perspective, their projection towards disease, their cultural background, and their access to support systems all contribute to this. As a result, their replies will inevitably differ and are natural manifestations in the complex environment. Tanabe et al. find a very high percentage of behavior problems, particularly hyperactivity and conduct problems; Novriska et al. find a modest difficulty score in their sample of more female children and adolescents; Triplett et al. find a modest difficulty score in their adolescent children; Modge et al. find a fairly high difficulty score in a very detailed informative study with a fairly large sample size; Gandhi et al. find a moderate difficulty score using the SDQ-S; and Berg AT et al. find a very modest difficulty score.[14–18] Looking back, several studies conducted in the past 20 years have used the Child Behavior Check List (CBCL) to assess children for behavioral issues. According to a 2005 study by Datta et al. with a sample size of 132 children and data gathered from parents, 53.8% of CWE had behavioral issues. The 118 behavior problem items of the CBCL are used by caregivers to rate their children. Make a suggestion for a basic behavior assessment tool. Choudhury et al. (2008) found that 43% of CWE children had behavioral issues in an observational research with a sample size of 100 children, the majority of whom were male. In their study, Misra et al. (2015) found that children and adolescents with epilepsy have mean behavioral scores that are significantly higher than those of the control group in all domains of emotional reactivity, withdrawn behavior, attention problems, aggressive behavior externalizing, and total behavior problems. The data was gathered through parents, and the sample size was 240 children with equal representation of male and female gender. The Kiddie Schedule for Affective Disorders and Schizophrenia (K-SADS), the Diagnostic Interview Schedule for Children, parent questionnaires to obtain a psychiatric diagnosis, and symptom-based standardized parent, teacher, or child self-report questionnaires were among the numerous other questionnaires used in the early studies. The review study by Berg et al. emphasizes the necessity for a balanced approach, understanding psychogenic non-epileptic seizures, systemic bias in parent-reported child behavior, and normal reactions to chronic diseases like epilepsy in the context of the community.[19] In a meta-analysis, Austin et al. highlight the significance of epilepsy's chronicity, the familial environment, sociocultural features of the community, and availability to a support system. They also examine how psychotic factors affect behavior. Additionally, polytherapy may lead to behavioralissues.[20–24]In his seminal works, Holmes et al. emphasize the lack of adequate clinical evidence and discuss the significance of epilepsy's impact on cognitive abilities.[23,24] In their paper, Eddy et al. emphasized the significance of ASM, particularly in relation to behavioral disorders.[24]

According to a review research by Mula et al. (2021), one in three CWE had behavioral comorbidity, casualty uncertainty, and an unanswered question regarding antipsychotic treatment regimen.[25]

CONCLUSION

In comparison to children without epilepsy, we have determined the frequency of externalizing and internalizing behavioral issues in CWE. The most important neurobehavioral issue that affected friendship and family life was peer relations. In order to improve their social inclusion, behavioral evaluation ought to be a component of routine care.

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