International Journal of Contemporary Pediatrics
Joshi SS et al. Int J Contemp Pediatr. 2026 Aug;13(8):1508-1512
https://www.ijpediatrics.com
pISSN 2349-3283 | eISSN 2349-3291
DOI: https://dx.doi.org/10.18203/2349-3291.ijcp20262428

Case Series

Developmental trajectory and functional outcomes in children with epilepsy: a descriptive case series

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Received: 26 April 2026
Revised: 08 June 2026
Accepted: 20 July 2026

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ABSTRACT

Early onset epilepsy has been reported in literature in as young as 2 years of age specially focusing on cognitive and executive function affection. However, effect of Epilepsy on physical function affection is under reported specially in children below 1 year of age. The objective here is to report a case series of 6 patients diagnosed with Epilepsy aged 9 months to 1.5 years at the time of their first visit to Physiotherapy OPD, with chief complaint of developmental delay/regression. This case series included six children diagnosed with Epilepsy and referred to Physiotherapy with the chief complaint of age-appropriate developmental delay in 4 children and regression in case of 2 children. Structural, genetic, and metabolic etiologies were confirmed with investigations in these children along with pre-epilepsy developmental milestone status through parent interview. Developmental status was examined before and after intervention using clinical assessment and Gross Motor Function Measure (GMFM) scores. Customised Physiotherapy intervention was given in accordance to structured short term goals. The baseline motor function ranged widely (GMFM 6%–52%). Early-onset epileptic encephalopathies demonstrated profound impairment, whereas non-progressive post-seizure cases showed moderate delay. Following intervention, five children demonstrated measurable GMFM improvement (19%-77.8%), most notably in trunk control, transitional movements, kneeling stability, and ambulation. Limited or negative progression was observed in children with progressive metabolic pathology. Thus, this case series provides the evidence for physical function affection in children with epilepsy under 1 year of age which improved substantially with neurophysiotherapy treatment.

Keywords: Paediatric epilepsy, Developmental regression, Neurophysiotherapy, Developmental delay

INTRODUCTION

Epilepsy is defined as the occurrence of two or more unprovoked seizures, one unprovoked seizure with a high likelihood of recurrence, or the diagnosis of a recognized epilepsy syndrome.[1] It is among the most common neurological disorders in children worldwide.[2,7] While seizure control remains the primary focus of management, increasing attention has been directed toward the broader developmental implications of childhood epilepsy, especially cognitive and neurobehavioural issues.[3]

Neurodevelopment during infancy and early childhood is characterized by rapid synaptic formation, network organization, and experience-dependent plasticity. Disruption during this period whether due to recurrent seizures, interictal epileptiform discharges, or underlying structural and genetic mechanisms may alter developmental trajectories.[3-5] Approximately one-third of children with epilepsy exhibit cognitive, behavioural, or motor comorbidities, reported in school going children (5-7 years).[2,8] Early-onset epilepsy has been particularly associated with Neurobehavioural comorbidities primarily focusing on cognitive and executice dysfunction in children between 5 to 15 years of age.[3,9]

Contemporary classification recognizes that many epilepsies in infancy and early childhood arise from

structural, genetic, or metabolic etiologies.[14] Developmental outcomes are therefore influenced not only by seizure burden but also by the underlying pathology. In India, paediatric epilepsy prevalence is estimated at approximately 0.8%, with regional variability.[13] Despite expanding epidemiological data, fewer studies describe functional outcomes from a rehabilitation perspective.

This case series aims to describe developmental patterns in children with epilepsy seen in a tertiary care neurorehabilitation setting and to examine functional change following structured physiotherapy intervention.

CASE SERIES

This descriptive case series was conducted at a tertiary care centre providing integrated paediatric neurology and neurophysiotherapy services. Six children aged between 11 months and 9 years with a confirmed diagnosis of epilepsy were included. All participants met established diagnostic criteria and had documented seizure onset and developmental records available for review.[1]

Children were included if seizure onset preceded or temporally coincided with developmental delay or regression. Structural, genetic, and metabolic etiologies were not excluded, as these represent common causes of early-onset epilepsy and are clinically relevant to developmental outcomes. Clinical data were obtained from medical records, caregiver interviews, and developmental milestone documentation. Gross motor function was assessed using the Gross Motor Function Measure (GMFM). Seizure characteristics, treatment status, and presence of drug resistance were noted.

Physiotherapy intervention was individualized and included neurodevelopmental treatment principles, trunk activation exercises, sensory re-education, task-oriented training, strengthening of proximal musculature, reflex integration techniques, and facilitation of transitional movements such as rolling, kneeling, and sit-to-stand. Ethical approval for the study was obtained from the DVVPF's COPT Ethics Committee and informed consent was obtained from the parents or legal guardians of all participants.

Case 1

A 3-year-old male diagnosed with cerebral palsy, presented with poor head control and inability to sustain neck holding at baseline. The child demonstrated a Gross Motor Function Measure (GMFM) score of 6%, which improved to 19% following intervention. Functional assessment initially revealed inability to maintain neck posture; however, at reassessment, intermittent neck holding with assisted rolling was observed. Intervention primarily emphasized Neurodevelopmental Treatment (NDT)-based facilitation of cervical extension, postural activation, and rolling, with progression toward pectoral activation and sustained postural control.

Case 2

A 2-year-old female with right hemiparesis following post-seizure disorder, demonstrated a GMFM improvement from 38% to 42%. At baseline, the child exhibited impaired right-hand grasp despite independent sitting. Following intervention, mild assistance was required for advanced transitional postures, including kneeling and half-kneeling. Rehabilitation focused on bimanual hand training, fine motor facilitation, and progression toward postural transitions and kneeling activities to improve functional independence.

Case 3

A 9-year-old male with cerebral palsy associated with Lennox-Gastaut syndrome, exhibited marked functional gains, with GMFM improving from 52% to 77.8%. Baseline abilities included sitting and crawling, whereas reassessment demonstrated independent ambulation up to 30 meters. Rehabilitation targeted sit-to-stand performance, postural alignment, lower limb stability, and gait-related motor control, progressing to advanced balance and strengthening activities, including single-leg standing and squat training.

Case 4

A 1.5-year-old male diagnosed with cerebral palsy and epilepsy, showed a GMFM increase from 43.1% to 47.05%. Initial limitations included inability to roll independently from prone to supine despite preserved hand opening. Following intervention, the child achieved supported rolling with improved postural engagement. Treatment emphasized sensory integration, visual tracking, and upper-limb weight-bearing activities in prone positioning to facilitate motor control.

Case 5

A 2-year-old male with developmental delay secondary to post-seizure disorder, demonstrated improvement in GMFM from 38% to 43.7%. Functional challenges at baseline included impaired rolling transitions, particularly from side-lying to prone. At follow-up, supported rolling and prone positioning tolerance improved. Intervention focused on rolling facilitation, core strengthening, sensory-motor training, and NDT-based postural facilitation to enhance trunk stability and transitional mobility.

Case 6

An 11-month-old female diagnosed with developmental delay secondary to gangliosidosis, demonstrated a decline in GMFM from 19.58% to 11.59% over the intervention period. At baseline, the infant required minimal assistance for rolling and supported positioning; however, reassessment indicated greater assistance requirements for rolling and sitting activities. Rehabilitation focused on

positioning, rolling facilitation, abdominal strengthening, and postural activation, although functional decline likely reflected the progressive nature of the underlying neurodegenerative condition.

So, six children with heterogeneous diagnoses were included: cerebral palsy with epilepsy, Lennox–Gastaut syndrome, post-seizure developmental delay, right hemiparesis following seizure disorder, and gangliosidosis, representing both static and progressive etiologies

At baseline, motor impairment ranged from profound to moderate, with GMFM scores between 6% and 52%. Infants with early epileptic encephalopathies showed severe motor limitations. The child with gangliosidosis demonstrated limited rolling and brief supported sitting due to poor trunk control. Children with non-progressive conditions exhibited moderate impairment, including incomplete rolling, poor transitions, reduced trunk activation, kneeling instability, and impaired standing alignment. The child with Lennox–Gastaut syndrome could sit and crawl but lacked independent ambulation and had lower limb malalignment.

After structured neurophysiotherapy, five children improved functionally. The child with Lennox-Gastaut syndrome showed the greatest gain (GMFM 52% to 77.8%), achieving short-distance independent ambulation and better sit-to-stand control. Children with post-seizure developmental delay and cerebral palsy with epilepsy demonstrated moderate gains in rolling, trunk activation, kneeling stability, and transitional control. The child with right hemiparesis improved in standing transitions and kneeling endurance. The child with gangliosidosis declined, consistent with disease progression.

Overall, improvements were most evident in trunk control, proximal stability, transitional movements, and weight-bearing alignment.

Table 1: Functional status: pre and post 1st onset of epilepsy; pre and post neuro PT intervention.

		Neck extension: stimulation, pectoral stretch, assisted rolling on swiss ball, side plank with visual focussing	**Active kneel sit to kneeling, Sustained kneeling with bimanual hand exercise**	**Squats, Single leg stand, Reflex integration, VMO strengthening**	**Sensory reeducation-visual tracking, tactile, Prone on elbows& hands, side plank, NDT supine to sit**	**Side plank with reach outs, NDT supine to sit, back extensor strengthening**	**NDT rolling, Abdominal and oblique curls, side plank**
	Current						
Interve-ntion	1st day	NDT neck extension activation, rolling initiation on swiss ball	Bimanual hand ex., fine motor hand training, kneel sit to kneeling with assistance	NDT sit to stand, kneel standing, kneel walking, sustained standing	Sensory reeducation-visual focusing, tactile, movt. sensitivity, Prone on elbows and hands, side plank	Rolling facilitation, Abd. & oblique curls, sensory re-education: T-swing, texture stimulation by sensory mat	NDT rolling, Abdominal and oblique curls, side plank
Treatmen t goals	Current	Neck extension facilitation, rolling facilitation, obliques activation	To perform independent kneel sit to kneeling, kneel stand sustenance	Postural Alignment, Reduce knee flexion and torsion, Reflex integration - ATNR	Hand weight bearing in prone& side plank position, minimal assistance supine to sit	Triceps activation, trunk control, supine to sit	Independent rolling, initiate supine to sit
	1st day	Neck extension activation, rolling initiation	To improve Rt. hand grasp and release, improve strength of Glutes and Quads	Sit to stand, Static Standing	Sensory integration, moderate assisted rolling, core activation	To improve rolling, core strengthening, sensory re-education	Independent rolling, initiate supine to sit

Continued.

	Current	**Neck extension: stimulation, pectoral stretch, assisted rolling on swiss ball, side plank with visual focussing**	**Active kneel sit to kneeling, Sustained kneeling with bimanual hand exercise**	**Squats, Single leg stand, Reflex integration, VMO strengthening**	**Sensory reeducation- visual tracking, tactile, Prone on elbows& hands, side plank, NDT supine to sit**	**Side plank with reach outs, NDT supine to sit, back extensor strengthening**	**NDT rolling, Abdominal and oblique curls, side plank**
Functional status	Current	Intermittent neck holding, mild assisted rolling	Mild assisted-kneel sit to kneeling, half kneeling, standing, fair Rt. hand grasp - release	Walks independently for 30 meters	Started – Rolling Prone to supine, hand opening, moderate Abd. & oblique activation	Started rolling: supine to prone, prone to supine, supine to sit independently	Rolling with moderate assistance
	1st day	Inability holding neck	Independent Sitting, poor Rt. hand grasp	Sitting, Crawling	Unable to roll from prone to supine, complete thumb in hand, minimal abdominal & oblique activation	Difficulty rolling from side lying to prone	Rolling with minimal assistance, propped up sitting < 5secs
GMFM score	Current	19%	42%	77.8%	47.05%	43.7%	11.59%
	1st day	6%	38%	52%	43.1%	38%	19.58%
Diagnosis		CP	Rt. hemiparesis post seizure disorder	Cerebral palsy with lennox gastaut syndrome	Cerebral palsy with epilepsy	Developmental delay post seizure disorder	Developmental delay secondary to gangliosidosis
Age (current)		3 yr M	2 yr F	9 yr M	1.5 yr M	2 yr M	11 months F

DISCUSSION

This case series highlights the heterogeneous developmental patterns observed in children with epilepsy in a tertiary rehabilitation setting. Baseline functional status reflected the combined influence of seizure burden, age of onset, and underlying etiology. Early epileptic encephalopathies were associated with profound motor impairment, consistent with evidence that epileptic activity during critical developmental windows disrupts cortical maturation and experience-dependent plasticity.[5,6,11]

Pre-intervention limitations were most prominent in proximal stability and transitional movements. Impaired trunk activation, reduced postural endurance, and difficulty initiating movement were common findings. These deficits align with current understanding of disrupted cortical–subcortical integration and motor network inefficiency in epilepsy.[10,15] In addition, recurrent seizures and interictal discharges may transiently impair attention and motor execution, contributing to reduced motor learning efficiency.[16]

Post-intervention findings suggest that meaningful functional gains are possible in children with non-progressive epilepsies. Improvements in GMFM scores corresponded with observable gains in rolling, kneeling stability, sit-to-stand transitions, and short-distance ambulation. The magnitude of improvement in the child with Lennox–Gastaut syndrome is notable, demonstrating that severe epilepsy syndromes do not uniformly preclude rehabilitation responsiveness.

Children with progressive etiologies demonstrated limited or negative functional change. In contrast, the child with Gangliosidosis demonstrated motor regression despite structured physiotherapy. This decline was likely related to the progressive nature of the underlying metabolic disorder and persistent seizure activity. As gangliosidosis is characterized by ongoing neurodegeneration, rehabilitation potential may be limited, and goals often shift toward maintenance and prevention of secondary complications. Follow-up was discontinued after discharge, limiting longitudinal assessment. This case underscores the importance of realistic goal setting in progressive epileptic conditions.

Improvements following physiotherapy intervention likely reflect activity-dependent neuroplastic mechanisms. Task-oriented training, repetitive activation of trunk musculature, sensory re-education, and alignment correction may enhance motor planning efficiency and proximal stability. Strengthening of gluteal and quadriceps musculature contributed to improved weight-bearing and standing control in ambulatory children. Even modest percentage increases in GMFM translated into clinically meaningful functional gains.

These findings reinforce the importance of early, individualized neurorehabilitation integrated with medical management. Developmental outcomes in epilepsy are multifactorial, influenced by etiology, seizure characteristics, medication effects, and environmental interaction [11,18]. Nevertheless, structured physiotherapy appears capable of facilitating functional improvement in appropriately selected cases.

The small sample size in the study and heterogeneity of diagnoses limit generalizability. The absence of long-term follow-up precludes assessment of sustained outcomes. As a descriptive case series, causal relationships cannot be inferred. Children with epilepsy demonstrate varied developmental trajectories influenced by seizure onset, etiology, and disease progression. While progressive metabolic conditions may show limited functional improvement, children with non-progressive epilepsy can achieve meaningful motor gains following structured neurophysiotherapy. Early identification and intervention remain essential components of comprehensive epilepsy care.

CONCLUSION

This case series provides the evidence on under reported cases of Paediatric Epilepsy specially in children below 1 year of age, having effect on physical function leading to developmental regression and how neurophysiotherapy treatment showed substantial improvement in them.

Funding: No funding sources
Conflict of interest: None declared
Ethical approval: Not required

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Cite this article as: Joshi SS, Ganvir SS. Developmental trajectory and functional outcomes in children with epilepsy: a descriptive case series. Int J Contemp Pediatr 2026;13:1508-12.