

Monday 1 December 2025

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Interventions and Management

1. Noninvasive brain stimulation for upper limb motor activity in children and young adults with cerebral palsy and pediatric stroke: a systematic review and meta-analysis

Juan-José Fernández-Pérez, Alfredo Lerín Calvo, David Rodríguez-Martínez, Álvaro Reina-Varona, Enrique Carrasco-González

J Neuroeng Rehabil. 2025 Nov 28. Online ahead of print.

Abstract
No abstract available.
PMID: [41316406](#)

2. Is there a directional relationship between windswept hips and scoliosis in children with cerebral palsy?

Elisabet Rodby-Bousquet, Hans Tropp, Atli Agustsson

BMC Musculoskelet Disord. 2025 Nov 28. Online ahead of print.

Background: The purpose of this study was to analyse if there is a relationship between the directions of windswept hip deformity and scoliosis for children with cerebral palsy (CP) and to explore potential associations with spasticity, contractures and hip displacement.

Methods: A cross-sectional registry-based study was conducted using data from the combined Swedish CP Follow-up Program and National Registry, including children aged 0-18 years across all levels of the Gross Motor Function Classification System. Prevalence and direction of windswept hip deformity was assessed based on calculations of passive range of motion in abduction, internal and external rotation of the hips. Scoliosis was defined as either a moderate or severe curve at clinical examination or a radiographic Cobb-angle of $\geq 20^\circ$. The direction of scoliosis was determined by the convexity of the spinal curve.

Results: A total of 4,453 children (mean age 10.2 years [SD 4.8]) were included. In total 774 (17.4%) had scoliosis ($n = 503$) or windswept hips ($n = 413$). Among these 141 had both scoliosis and windswept hips allowing for analyses of directional relationships. The scoliosis and windswept hip deformity were going in opposite directions in 75 of the 141 children, and in the same direction in 66 children. More children with scoliosis and windswept hips to the same side had a contralateral hip displacement ($p < 0.001$). Whereas children with deformities in opposite directions more frequently had a hip displacement contralateral to the windswept hip deformity. The direction of the scoliosis was associated with a contralateral hip displacement ($p = 0.020$). The direction of the windswept hip deformity was associated with a contralateral hip displacement ($p < 0.001$), hip flexion contracture ($p = 0.002$) and spasticity in the hip adductors on the opposite side ($p < 0.001$).

Conclusions: There is no clear directional relationship between windswept hips and scoliosis in children with CP. However, the direction seems to be highly associated with the location of hip displacement, hip flexion contracture and spasticity of the hip adductors. These findings suggest that preventing and treating contractures in the lower extremities, along with active hip surveillance, may help reduce the development of both scoliosis and windswept hip deformity.

PMID: [41316164](#)

3.Pre-operative zoledronate is safe for children with medical complexity undergoing posterior spinal fusion for neuromuscular scoliosis

Karim Aboelmagd, Samuel Yoon, Archana Sivakuganandan, Amna Zulfiqar, Anne Murphy, Stanley Moll, Julia Sorbara, Brett Rocos, David Lebel, Mark Camp

Spine Deform. 2025 Nov 28. Online ahead of print.

Purpose: Despite evidence for the safety and efficacy of zoledronate infusions in pediatric conditions (e.g., osteogenesis imperfecta), its tolerance, safety, and efficacy in medically complex children with neuromuscular scoliosis have not been established. The aim of this study was to determine adverse events associated with pre-operative zoledronate therapy in this patient population.

Methods: A retrospective review was conducted of patients who had undergone pre-operative zoledronate infusions as part of pre-operative optimization at a single tertiary pediatric referral center. The protocol included three infusions with an initial 0.0125 mg/kg dose, a 0.0375 mg/kg dose at 6 weeks, and a 0.05-mg/kg dose at 6 months. Surgery was scheduled no sooner than 6 weeks after infusion.

Results: 47 patients received at least one pre-operative zoledronate infusion, with 66% receiving three infusions of zoledronate. The most common neuromuscular conditions were cerebral palsy (57%), epileptic encephalopathy (12.8%) and Rett syndrome (10.6%). Six minor adverse events were noted, including 2 episodes of post-infusion hypocalcemia, 2 of self-limited flu-like symptoms, 1 of nephrolithiasis, and 1 of unspecified hypotension which resolved after oral fluids. There were no events requiring hospital admission or emergency department presentation related to zoledronate infusions.

Conclusion: No major events were noted after pre-operative zoledronate infusions. The minor adverse events noted were self-resolving or resolved with minimal intervention. Zoledronate infusion can safely be included as part of a pre-operative optimization pathway in medically complex patients with neuromuscular scoliosis. Further research is required to optimize patient selection, infusion dose and schedule, impact on screw pull-out, and long-term complications.

PMID: [41310317](#)

4.Traditional Growth-Friendly Implants Result in Improved Health-Related Quality of Life in Cerebral Palsy Patients with Early-Onset Scoliosis

Nicholas J Buckler, Margaret Sun, Mason Al Nouri, Jason J Howard, Majella Vaughan, Tricia St Hilaire, Hiroko Matsumoto, Paul D Sponseller, John T Smith, George H Thompson, Pediatric Spine Study Group, Ron El-Hawary

J Pers Med. 2025 Oct 24;15(11):506.

Background/Objectives: In an effort to promote personalized medicine, the purpose was to (1) analyze health-related quality of life (HRQoL) in cerebral palsy (CP) patients treated with growth-friendly implants for early-onset scoliosis (EOS), and (2) compare traditional implants (traditional growing rods [TGRs], VEPTR) with magnetically controlled growing rods (MCGRs). **Methods:** Twenty-four patients with CP and EOS were identified from an international multicenter database. Mean EOSQ-24 domain and total scores and absolute differences from pre-index surgery to the minimum two-year follow-up were compared.

Results: For all patients: Pre-index surgery EOSQ-24 total score: 48.9 vs. follow-up: 53.8. Follow-up scores were greater than at pre-op for 10 of the 12 domains, with the only significant difference being activities of daily living. Growth-friendly implants had positive absolute differences for 8 of the 12 domains and in the total score. Nine traditional implant patients had a pre-index surgery EOSQ-24 total of 45.8 points, while 15 MCGRs patients had a score of 50.8 points. At follow-up, traditional implant patients had greater scores than at pre-index surgery for all 12 domains, with total score of 55.1 points, and positive absolute differences for all domains (non-significant). MCGRs had greater scores than at pre-index surgery for six domains, with a total score of 53.1 points (non-significant), and positive absolute differences for seven domains. Traditional implants had a significantly greater absolute difference for emotion than MCGRs ($p = 0.030$).

Conclusions: At the minimum two-year follow-up, CP patients had small, but statistically non-significant, improvements in HRQoL following growth-friendly surgery. Compared to MCGRs, traditional implants provided a modest additional benefit in HRQoL.

PMID: [41295208](#)

5. Relationship between sensory profile, balance, and trunk control in children with cerebral palsy

Busra Bengi Kemerden, Dilek Cokar, Zeynep Kavrik

J Bodyw Mov Ther. 2025 Dec;45:1101-1105. Epub 2025 Nov 3.

Aim: Cerebral Palsy (CP) is a neurodevelopmental disorder that affects sensory processing, balance, and trunk control. This study aimed to examine in detail the relationship between sensory profiles, balance, and trunk control in children with quadriparetic CP, in order to provide evidence for integrating sensory-targeted strategies into rehabilitation.

Method: The study included 32 children diagnosed with spastic quadriparesis. Sensory processing was assessed using the Dunn Sensory Profile, balance was evaluated with the Pediatric Balance Scale (PBS), and trunk control was measured using the Trunk Control Measurement Scale (TCMS).

Results: A total of 32 children were assessed. Sensory processing disorders were identified in 81.5 % of the assessed parameters. Balance scores showed significant positive correlations with vestibular processing ($p = 0.014$, $r = 0.429$), proprioception ($p = 0.017$, $r = 0.417$), endurance and tone regulation ($p = 0.036$, $r = 0.372$), sensitivity to stimuli ($p = 0.011$, $r = 0.444$), and sensory seeking ($p = 0.039$, $r = 0.366$). Similarly, trunk control was positively correlated with stimuli perception ($p = 0.014$, $r = 0.430$), vestibular processing ($p = 0.034$, $r = 0.377$), oral sensory processing ($p = 0.008$, $r = 0.463$), and sensitivity to stimuli ($p = 0.039$, $r = 0.367$).

Conclusion: Difficulties in sensory processing, particularly in the vestibular, proprioceptive, somatosensory, and oral domains, were associated with impairments in balance and trunk control. These findings highlight the importance of evaluating sensory profiles in children with CP and support the inclusion of sensory-focused assessments and interventions in rehabilitation programs to improve motor and functional outcomes.

PMID: [41316562](#)

6. Editorial: Neuromuscular and kinematic dynamics in human movement adaptation

Rajat Emanuel Singh, Jennifer L Davies, Catherine Purcell

Front Hum Neurosci. 2025 Nov 11;19:1724225. eCollection 2025.

Abstract

No abstract available.

PMID: [41307073](#)

7. Advancements in Understanding Spasticity: A Neuromusculoskeletal Modeling Perspective

Mohammad S Shourijeh, Argyrios Stampas, Shuo-Hsiu Chang, Radha Korupolu, Gerard E Francisco

J Clin Med. 2025 Nov 15;14(22):8092.

Abstract

Spasticity, a complex consequence of upper motor neuron lesions, poses challenges for clinical assessment due to its neural and mechanical origins. Traditional scales like the Modified Ashworth and Tardieu Scales provide subjective, context-limited insights, often missing spasticity's dynamic nature. Neuromusculoskeletal (NMS) modeling offers objective, quantitative insights by integrating patient-specific muscle-tendon properties, reflex dynamics, and multi-joint biomechanics. This scoping review examines advancements in spasticity modeling, comparing mechanical, neurological, and integrated approaches, and their applications in conditions like cerebral palsy and stroke. We highlight barriers to clinical translation, including computational demands and regulatory challenges, and propose future directions, such as real-time simulation and machine learning integration, to enhance personalized assessment and treatment.

PMID: [41303128](#)

8. Correction: White et al. AFOs Improve Stride Length and Gait Velocity but Not Motor Function for Most with Mild Cerebral Palsy. *Sensors* 2023, 23, 569

Hank White, Brian Barney, Sam Augsburg, Eric Miller, Henry Iwinski

Sensors (Basel). 2025 Nov 10;25(22):6862.

Abstract

The Editorial Office and Editorial Board of *Sensors* are jointly issuing a resolution and removal of the Journal Notice linked to this article [...].

PMID: [41305308](#)

9. The effects of weight-bearing manipulations on gait and its underlying neural control mechanisms in toe walking children

Michelle Gwerder, Rosa M S Visscher, Anusha Spescha, Seyyed H Hosseini Nasab, Yong K Kim, Regine Zibold, Reinald Brunner, William R Taylor, Elke Viehweger, Navrag B Singh

Front Hum Neurosci. 2025 Nov 10;19:1701454. *eCollection* 2025.

Introduction: In toe walking children, impaired maturation of neuromotor control often leads to persistent use of immature motor programs. Understanding the underlying etiology of toe walking in children with cerebral palsy (CP) and idiopathic toe walking (ITW) is crucial for advancing rehabilitation strategies. This study examined gait adaptations and H-reflex responses to varied weight-bearing conditions to determine whether children with ITW and CP exhibit distinct neuromotor control strategies compared to typically developing (TD) peers.

Methods: Eight children with CP (mean age 12.9 ± 2.1 years), eight with ITW (8.6 ± 1.9 years), and 19 TD children (10.0 ± 2.6 years) walked on a treadmill under three conditions: normal bodyweight, 30% bodyweight unloading, and 30% additional bodyweight. Linear mixed-effects models assessed spatiotemporal gait parameters, margin of stability, gait variability, and H-reflex responses.

Results: Bodyweight unloading increased single-limb support time, while reducing double-limb support time and antero-posterior margin of stability across groups ($p < 0.01$). ITW children exhibited increased gait variability ($p < 0.01$) under bodyweight unloading, while CP children showed no change. H-reflex amplitudes decreased under bodyweight unloading in TD children, while CP children exhibited hyperreflexia ($p < 0.05$).

Discussion: The findings of this exploratory study suggest that toe walking is associated with distinct adaptive strategies in ITW and CP children to compensate for environmental challenges. In ITW, increased variability under bodyweight unloading may reflect exploratory motor control, whereas CP children relied on stiffening strategies, marked by reduced variability and hyperreflexia, indicating limited adaptability and less efficient gait patterns. These results imply that similar biomechanical constraints evoke divergent neuromotor adaptations in ITW and CP children.

PMID: [41293482](#)

10.Changes in lower extremity kinematics with free and restricted arm swings in children with unilateral cerebral palsy

İlker Abdullah Sarıkaya, Meltem Çelik, Osman Doğan, Barış Görgün, Ozan Ali Erdal, Muharrem İnan

Gait Posture. 2025 Nov 13;124:110047. Online ahead of print.

Background: Children with unilateral cerebral palsy (UCP) often exhibit asymmetry, which significantly impacts gait function. Arm swing plays a crucial role in gait mechanics and asymmetric arm movements are hypothesized to influence lower extremity kinematics.

Research question: How does restricting arm swing in children with unilateral cerebral palsy affect the kinematic parameters of lower extremity?

Methods: A prospective cohort study was conducted with 19 children aged 5-18, diagnosed with UCP, who were able to walk independently. Participants underwent 3D gait analysis under four conditions: no arm restriction (NAR), healthy arm restricted (HAR), affected arm restricted (AAR), and both arms restricted (BAR). Comparative analysis was conducted using the Friedman Test and multiple pairwise comparisons with bootstrapping.

Results: Pelvic rotation and obliquity showed significant improvements with HAR compared to NAR, with the pelvis moving closer to neutral alignment. Knee flexion during the swing phase increased with BAR, addressing a common deficit in UCP patients. Ankle dorsiflexion improved with both arm restrictions but remained impaired with only HAR.

Conclusion: In conclusion, arm restriction has an influence on lower extremity gait kinematic in children with UCP. Restriction of the unaffected arm movement has a corrective effect on pelvic kinematics. Similarly, restricting both arms improve swing phase knee flexion. These results can be useful for gait rehabilitation strategies of UCP children.

PMID: [41273954](#)

11.Effect of Pilates exercise on balance in adults with cerebral palsy

Hee Joung Joung, Soon-Sun Kwon, Moon Seok Park

J Bodyw Mov Ther. 2025 Dec;45:311-318. Epub 2025 Sep 6.

Introduction: Adults with cerebral palsy (CP) experience a progressive decline in balance, which leads to reduced mobility and quality of life. Despite the importance of health management, few studies have examined exercise interventions in adults with CP. Although Pilates exercises have been shown to improve balance in neurological populations, their effects on adults with CP remain unclear. This feasibility study investigated the effects of Pilates on balance in adults with CP.

Method: This feasibility study employed a non-randomized controlled design with a pre-post comparison. Seventeen adults with CP voluntarily chose either the Pilates group (PG; n = 10, mean age 51.4 ± 3.40 years) or the control group (CG; n = 7, mean age 51.57 ± 3.82 years). The PG completed a 12-week Pilates intervention (90-min sessions, twice weekly, 24 sessions), whereas the CG maintained their usual activities without intervention.

Results: Balance was assessed using the center of pressure displacement with eyes open (CoP_EO), and eyes closed (CoP_EC), the Berg Balance Scale (BBS), and the Timed Up and Go test (TUG). The PG showed significant improvements compared with the CG in CoP_EO ($p = 0.025$), CoP_EC ($p = 0.013$), BBS ($p = 0.002$), and TUG ($p = 0.006$).

Conclusion: These findings suggest that Pilates may be a feasible intervention for improving balance in adults with CP.

PMID: [41316592](#)

12. Comparison of the Effects of Elastic and Rigid Taping on Gross Motor Function, Balance, and Functional Capacity in Children with Hemiplegic Cerebral Palsy: A Randomized, Single-Blinded Trial

Duygu Korkem Yorulmaz, Rıdvan Gök, Emine Handan Tüzün, Duygu Türker, Buse Birbir, Tezel Yıldırım Şahan

Children (Basel). 2025 Nov 17;12(11):1551.

Background/Objectives: This randomized, single-blinded trial compared the effects of Kinesio taping (KT) and rigid taping (RT) on gross motor function, balance, and functional capacity in children with hemiplegic cerebral palsy (HCP).

Methods: Fifty-two children (aged 7-16) were assessed using the Gross Motor Function Measure (GMFM), Pediatric Berg Balance Scale (PBBS), Time-Up-and-Go (TUG), and 2-Minute Walk Test (2-MWT).

Results: Both KT and RT produced significant intra-group improvements in GMFM, PBBS, TUG, and 2-MWT scores ($p \leq 0.001$). Although nonparametric analysis suggested greater changes for KT in TUG and 2-MWT ($p < 0.001$; $p = 0.036$), no significant inter-group differences were found when baseline scores were adjusted using the General Linear Model (GLM) (2-MWT: $p = 0.29$; TUG: $p = 0.087$).

Conclusions: KT and RT are similarly effective adjuncts to physiotherapy, improving gross motor function, balance, and functional capacity in children with HCP. Therefore, the choice between KT and RT may be guided by clinical preference, child tolerance, and therapeutic goals rather than superiority of effect.

PMID: [41300667](#)

13. Free-living physical activity levels in children with cerebral palsy

Maija Piiparinen, Pedro Valadao, Tiina Savikangas, Ying Gao, Francesco Cenni, Taija Finni

Clin Biomech (Bristol). 2025 Nov 21;131:106713. Online ahead of print.

Background: Cerebral Palsy (CP) is a common motor disorder in children, leading to reduced physical activity (PA) and increased health risks. To complement traditional PA methods (e.g., accelerometers, self-reports), electromyography (EMG) provides physiologically relevant information on muscle activity during free-living. This study used EMG for assessing daily muscle activity in individuals with CP and their typically developing (TD) peers.

Methods: Shorts with embedded EMG electrodes and hip-worn tri-axial accelerometer recorded daily PA in 8 children with spastic CP (mean age 14y 7mo, Gross Motor Function Classification System (GMFCS) I (n = 5), III (n = 3)) and 6 TD children (mean age 15y 4mo) during free-living. Daily EMG activity levels are reported as a percentage of mean EMG amplitude during the 6MWT. Inactivity time and light, moderate and vigorous PA are reported relative to recording time using established cut-off values for accelerometry, and EMG amplitude categorized based on a two-minute average from the middle of 6MWT.

Findings: Free-living EMG inactivity (CP: 58.4%, TD: 50.4%) and activity levels did not differ statistically between CP and TD groups. Accelerometry showed a greater inactivity time than EMG in CP ($p = 0.021$) and TD ($p = 0.010$) groups. In CP, few statistically significant differences were observed between legs, muscles, and GMFCS levels.

Interpretation: Free-living EMG monitoring did not reveal excessive muscle activity in individuals with CP during daily activities compared to TD peers. EMG detects light PA that accelerometry may underestimate, offering a more detailed view of daily muscle use.

PMID: [41297159](#)

14. Research on cerebral palsy football: a scoping review

Rui Bao, Xinpu Wang, Yuchen Shi, Miguel Ángel Gómez Ruano

BMC Sports Sci Med Rehabil. 2025 Nov 25. Online ahead of print.

Abstract

No abstract available.

PMID: [41291919](#)

15.Improvement of spinal sensorimotor adaptation in children with cerebral palsy with various locomotor patterns using botulinum therapy and compression orthoses

D A Krasavina, D O Ivanov, A V Chemeris, O R Orlova, P N Iakovleva, M A Akulov

Zh Nevrol Psikhiatr Im S S Korsakova. 2025;125(10. Vyp. 2):127-135.

Abstract

At the core of any rhythmic movement, including walking, lies the function of Central Pattern Generators (CPGs) - neuronal circuits in the spinal cord. Spastic forms of cerebral palsy (CP) hinder full locomotion. CPGs, in the absence of supraspinal control, can generate locomotor patterns independently, which can affect the ability to move both positively and negatively. In rehabilitation, we aim to increase the afferent flow of impulses in patients with CP, which is possible when combining botulinum toxin therapy and providing patients with compressive orthoses. These orthoses can improve the performance of motor tasks in children with CP. Walking, running, and swimming lead to rhythmic arm movements along with the legs through coordination between the central pattern generators of the upper and lower extremities. The absence of coordination or increased spasticity in the upper and lower extremities can be the cause of activation of pathological motor patterns. Thus, spinal cord neuronal circuits become generators of pathologically increased excitation, shaped as a result of a focal organic lesion of the central nervous system. Injections of Botulinum Toxin A (BTX-A) in the upper extremity allow modifying the formation of dominant synergy. Wearing compressive orthoses (corsets, leggings, or long-sleeved shirts) helps create the correct locomotion. Based on the analysis of modern research, a range of botulinum toxins has registered an effective and favorable safety profile for BTX-A (incobotulinumtoxin A) use in children with CP. The combination of botulinum toxin therapy, orthoses, and physical therapy is a dominant factor in rehabilitation.

PMID: [41283844](#)

16.Morphological and Motor Ability Adaptations Following a Short-Term Moderate-Intensity Strength Training Intervention in a Sedentary Adult Male with Asymmetrical Bilateral Spastic Cerebral Palsy: A Case Study

Aleksandra Popović, Marko Kapeleti, Igor Zlatović, Milica Janković, Anastasija Kocić, Vladimir Mrdaković, Marija Macura

J Funct Morphol Kinesiol. 2025 Nov 17;10(4):442.

Background: Cerebral palsy (CP) is a group of permanent disorders affecting movement, posture, and balance. Spasticity is the most common movement disorder in CP, and muscle weakness is its primary impairment. There is a lack of studies that have examined the effects of short-term, moderate-intensity strength training (ST) in adults with CP, whereas recommendations suggest that long-term interventions are necessary for substantial improvements in strength in the CP population. This study investigated the effects of a 5-week, moderate-intensity ST intervention, that targets various upper and lower extremity muscles, on multiple morphological characteristics (MC) and motor abilities (MA) in a sedentary 30-year-old adult male with asymmetrical bilateral spastic CP level II.

Methods: Body composition, maximal knee strength, maximal squat strength, leg explosive strength, and hip mobility were assessed before and after the ST intervention.

Results: Changes in body composition were modest (0.6–6.4%). Maximal knee strength increased moderately on the less spastic side (40.7–65.9%) and substantially on the more spastic side (118.5–130.6%). Hip mobility showed a similar pattern, with small to moderate improvements (11.4–30.0%), while maximal squat strength and leg explosive strength increased moderately (29.5–46.3%).

Conclusions: A short-term, moderate-intensity ST intervention produced meaningful improvements in MC and MA in this subject, especially on the more spastic side. The applied ST program was feasible and potentially efficient, and the results of this single-case study support its approach and methodology in necessary future studies on larger trials in an attempt to generalize these preliminary findings. This in turn may encourage practitioners to promote increased participation in physical activity among individuals with CP, given the short-term period of adaptations. The study discusses the potential of further refinement of the existing CP-specific ST guidelines and load programming aspects.

PMID: [41283549](#)

17.Exploring Impacts of Integrating a Rehabilitation Dog into Physiotherapy from the Perspectives of Children with Cerebral Palsy and Their Caregivers

Valerie Caron, Alison Oates, Julie Petrin, Romany Pinto, Joel Lanovaz, Sarah Oosman, Colleen A Dell, Sarah Donkers

NeuroRehabilitation. 2025 Nov;57(3):377-388.

Background: Rehabilitation for children with cerebral palsy (CP) often includes physiotherapy to enhance community participation and quality of life. Animal-assisted services (AAS) are a novel approach in physiotherapy to increase motivation, enjoyment and wellbeing. Our team conducted a study integrating a rehabilitation dog (Loki) into animal-assisted physiotherapy (AA-PT) for children with CP. This study presents the experiences and perspectives of children with CP who worked with Loki.

Methods: Interpretive Description approach with reflective thematic analysis was used. Semi-structured interviews were completed at two timepoints: T1) single timepoint walking with Loki; T2) after an 8-week AA-PT intervention with Loki (subset of participants).

Results: Ambulatory children with CP aged 7-16 years (n = 11 (T1); n = 4 (T2)) and their caregiver (n = 11 (T1); n = 4 (T2)) participated. Three themes describing the perceived impact of working with Loki were described: 1) Connection, Relationship and Bonding; 2) Being upheld: physical support and emotional safety; 3) Empowerment Through Participation and Confidence. **Conclusion:** Children with CP and their caregivers reported immense enjoyment and value in having Loki present as part of the physiotherapy intervention. Centered around an immediate bond formed with Loki, the emotional and physical support children experienced improved willingness to participate in the AA-PT and in community following interactions with Loki.

PMID: [41277278](#)

18.Effects of Pallidal Deep Brain Stimulation on Speech and Swallowing in Pediatric Patients with Dystonia

Katerina Bernardi, Andrea A Kühn, Ana Luísa de Almeida Marcelino, Matthias Eckenweiler, Cornelia Rensing-Zimmermann, Joachim K Krauss, Joachim Runge, Rene Marquez Franco, Delia Lorenz, Monika Müller, Alfons Schnitzler, Andrea Bevo, Lidwin von Spee, Veerle Visser-Vandewalle, Lars Timmermann, Petra Schiller, Anne Koy

Mov Disord Clin Pract. 2025 Nov 27. Online ahead of print.

Background: Bilateral globus pallidus internus deep brain stimulation (GPi-DBS) is a proven safe and effective treatment in certain forms of idiopathic or inherited dystonia (ID/IN). Its effects in acquired dystonia such as in dyskinetic cerebral palsy (DCP) however vary widely. The impact of GPi-DBS on speech and swallowing, which significantly affect quality of life, remains poorly understood, especially in pediatric patients.

Objective: To evaluate GPi-DBS effects on speech and swallowing using the Frenchay Dysarthria Assessment 2 (FDA-2), in pediatric patients with dystonia, and assess how the effects differ between DCP and ID/IN patients.

Methods: This pro- and retrospective multicenter study analyzes speech and swallowing pre- and 12 months post-GPi-DBS using FDA-2, including prospective data from the STIM-CP trial and retrospective data from the GEPESTIM registry.

Results: Twenty-six patients were included (17 male, 9 female; 14 DCP, 12 ID/IN) with mean age of 12.2 years at DBS. No significant changes in FDA-2 total scores were observed pre- and post-DBS (pre: 46.3 ± 33.6 ; post: 46.3 ± 34.2). ID/IN patients showed consistently higher scores compared to DCP patients both pre- and post-DBS ($P < 0.005$). When adjusted for age, medication, and pre-surgical values, group differences narrowed, with minimal changes from baseline in both groups.

Conclusion: GPi-DBS did not significantly change FDA-2 scores pre- and post-DBS. Assessing speech and swallowing in pediatric patients with dystonia, impaired expressive language and/or intellectual disability is challenging. More comprehensive and patient-centered assessment tools are needed to fully capture DBS effects on these domains in these complex disabled patients.

PMID: [41307194](#)

19. Mortality for pneumonia and risk of pneumonia in children with cerebral palsy treated with and without surgery

Matti Ahonen, Ira Jeglinsky-Kankainen, Mika Gissler, Ilkka Helenius

Eur Spine J. 2025 Nov 26. Online ahead of print.

Purpose: The aim of this study was to compare the incidence of pneumonia and pneumonia-related mortality in children with cerebral palsy (CP) and scoliosis, with and without scoliosis surgery.

Methods: National registries were searched for individuals with CP and scoliosis born after 1987 with recordings between 1996 and 2021. Identified individuals were categorized according to scoliosis surgery and were compared for pneumonia incidence and pneumonia-related mortality. Multivariable Cox regression examined determinants of mortality.

Results: We identified 474 children with CP and scoliosis, of these 236 children had not undergone surgery, while 238 had been operated. Both groups had similar rates of comorbidities. While there was no change in number of individuals with at least one hospitalization for pneumonia, there was significant reduction in cumulative pneumonia incidence from before to after surgery (175.5 vs. 121.5 hospitalizations per 1,000 years, $p < 0.001$), while incidence did not change in non-surgically treated patients (192.8 vs. 203.9, hospitalizations per 1,000 years, $p = 0.35$). During follow-up pneumonia-related mortality was significantly higher in the non-surgically treated group than in the surgically treated group ($n = 21/236$, 8.9% vs. $n = 8/238$, 3.3%, $p = 0.008$). After adjusting for covariates surgical patients had 87.5% reduction in risk of mortality to pneumonia compared with non-surgically treated patients (hazard ratio: 0.125, 95% confidence interval: 0.051-0.31, $p < 0.001$).

Conclusions: These results indicate that surgical treatment of scoliosis in children with CP associates to reduced incidence of pneumonia and pneumonia-related mortality.

PMID: [41291093](#)

20. Improving Foot Rocker via Robot-Resisted Gait Training with Self-awareness Biofeedback in Adults with Cerebral Palsy

Souvik Poddar, Jaehyung Park, Eleonora M Botta, Lora Cavuoto, Jeanne Langan, Jiyeon Kang

IEEE Trans Neural Syst Rehabil Eng. 2025 Nov 24. Online ahead of print.

Abstract

Cerebral palsy (CP) is a non-progressive neurological disorder that impairs motor control and coordination due to brain injury or abnormalities before, during, or shortly after birth. Although robotic gait training can improve overall gait patterns in CP, interventions targeting the 'foot rockers' motion, essential for stable weight transfer and effective push-off, have received limited attention. In this study, five adults with CP were recruited to train on a robotic treadmill system in which controlled downward forces were applied to the pelvis during walking, promoting implicit motor learning to develop an improved foot rockers strategy. Following this, during overground walking, participants received distinct real-time auditory cues at heel strike and push-off, providing self-awareness feedback to reinforce and maintain the foot rockers pattern acquired during treadmill training. Post-training analyses reported increased Tibialis Anterior activation during early stance, enhancing dorsiflexion and heel strike, and greater Soleus and Gastrocnemius engagement in late stance for stronger push-offs ($p < 0.05$). These functional gains were reflected in key spatiotemporal metrics: longer step length, greater toe clearance, a reduced stance percentage, and a shorter double stance time ($p < 0.05$). Participants also exhibited increased range of motion of the foot and increased knee and hip extension throughout stance, reflecting a more upright lower limb ($p < 0.05$). Survey responses confirmed that participants acknowledged the resistive treadmill training for strengthening their muscles and influencing their walking patterns, and reported that the auditory biofeedback enhanced their awareness of heel-to-toe contact. Participants emphasized the necessity of incorporating both interventions, highlighting its potential as a promising approach to improving foot rockers and overall gait pattern in adults with CP.

PMID: [41284415](#)

21. Wearable neurotechnology systems for upper extremity rehabilitation in children with cerebral palsy: a scoping review

Sara Jo Burchfield, Angela Shierk, Cindy Truong, Regan Blankenship

Front Neurol. 2025 Nov 5;16:1663596. eCollection 2025.

Background: Children with cerebral palsy often experience persistent upper extremity impairments that impact independence and participation in daily activities. Wearable neurotechnology devices offer a promising, non-invasive approach to enhance motor control, promote neuroplasticity, and extend neurorehabilitation beyond clinical settings. However, the development and application of such devices in pediatric populations remains poorly defined. This scoping review aimed to map the existing literature on wearable neurotechnology systems used for upper extremity rehabilitation in children with cerebral palsy and identify knowledge gaps to guide future research and clinical translation in pediatric neurorehabilitation.

Methods: This review followed the JBI Scoping Review Methodology and PRISMA-ScR guidelines. Four electronic database sources, MEDLINE, Scopus, CINAHL, and PsycINFO, were systematically searched to identify studies on wearable neurotechnology devices for upper extremity rehabilitation in children with cerebral palsy. Included studies consisted of journal articles published from January 2005 to June 2025, with full texts available in English and relevant gray literature sources. Data were extracted on neurotechnology characteristics, regulatory status, intervention protocols, and outcome measures.

Results: From the 2,892 articles screened, 21 met the eligibility criteria. Most devices were in early developmental stages, with only five receiving regulatory approval. Studies examined various systems, including electromyography-triggered stimulation, virtual reality, and robot-assisted devices with haptic or electrical stimulation, and wearable garments embedded with electrical or vibrotactile stimulators. Intervention protocols varied widely across studies in terms of treatment intensity, wear schedules, and co-interventions. Feasibility was generally positive across studies, with high adherence rates and minimal adverse events reported. Many studies reported improvements in motor outcomes, including enhanced grip strength, hand use, range of motion, grasp and release ability, and muscular recruitment.

Conclusions: Wearable neurotechnology shows potential to augment upper extremity rehabilitation in children with cerebral palsy, particularly through systems that support task-specific, feedback-driven practice. However, translation to clinical practice is limited by heterogeneity in device design, lack of standardized protocols, and limited high-quality evidence. Future research should prioritize standardization, clinician-centered implementation studies, and long-term outcomes to support integration into pediatric care.

PMID: [41281567](#)

22. Regional Disparities in Psychological Challenges Among Parents of Children With Cerebral Palsy in Pakistan: A Comparative Qualitative Study

Habib Ullah, Summiya Ahmad, Irshad Ahmad, Bilal Ahmad

Child Care Health Dev. 2026 Jan;52(1):e70193.

Background: This comparative qualitative case study examined psychological challenges associated with parents of children who have cerebral palsy (CP) in Pakistan's provinces and sought to identify provincial differences driven by socioeconomic, cultural and healthcare conditions.

Method: A comparative qualitative case study approach was used to collect data through semi-structured interviews with a total of 40 parents, 10 from each province: Punjab, Sindh, Baluchistan and Khyber Pakhtunkhwa (KP). To uncover shared patterns and provincial contrasts, the collected data, through face-to-face interviews, was thematically analysed.

Results: Six key themes emerged including psychological impact on parents, daily caregiving challenges, effects on parental health and well-being, lack of social and family support, financial burden and coping and resilience. The caregivers in Baluchistan and KP provinces demonstrated a higher level of anxiety, depression and social isolation compared to those in Punjab and Sindh provinces. These differences give the impression of a close relation to limited healthcare accessibility, poor socioeconomic status and a higher level of cultural stigma in these less developed areas.

Conclusion: The study highlights the pressing need for tailored, region-specific solutions to tackle the distinct challenges caregivers face in these different provinces. Interventions should focus on expanding healthcare services, offering financial aid, challenging harmful societal attitudes, strengthening community networks and enacting fairer policies to support families caring for children with CP.

PMID: [41315882](#)

23. Common data elements of cerebral palsy registries in Arabic-speaking countries: A scoping review

No authors listed

Dev Med Child Neurol. 2025 Nov 26. Online ahead of print.

Abstract

No abstract available.

PMID: [41305871](#)

24. Interdisciplinary Assessment of Premature Newborns and Their Families in a Hospital Setting in Medellín, Colombia

Juan Esteban López Cardona, Angie Estefanía Mesa Burbano, Leidy Yohana Apolinar Joven, Jenny Paola Ojeda Casallas, Natalia Pérez Doncel, Jhonatan Smith García Muñoz

Children (Basel). 2025 Nov 3;12(11):1483.

Background: Preterm infants are highly fragile and at increased risk of developing Cerebral Palsy (CP). Therefore, early detection through an interdisciplinary approach is necessary to enable timely referrals and evidence-based interventions. The literature recommends the use of the Hammersmith Infant Neurological Examination (HINE), the WHOQOL-BREF quality of life questionnaire, and the Comprehensive Neonatal Speech-Language Assessment Protocol (EFIN) for early CP diagnosis. However, despite the availability of these tools, they have not yet been implemented as part of evaluation and follow-up protocols in Colombia.

Methods: A cross-sectional observational and analytical study was conducted to analyze, in a group of preterm infants, the relationship between neurological risk, primary stomatognathic functions (suction-swallowing-breathing), and caregivers' perceived quality of life.

Results: A total of 43 preterm infants were included. Of these, only 9.30% showed neurological risk; 97.67% did not present alterations in the suction-swallowing-breathing triad; and the lowest quality of life scores were reported in social relationships and psychological health.

Conclusions: There are perinatal factors that require follow-up in preterm infants to prevent possible future complications. It is essential to address both social and psychological aspects in family support programs.

PMID: [41300600](#)

25. DCLA: Deep Cooperative Learning for Advancing Automated Annotation of Electronic Medical Records in Cerebral Palsy

Meirong Xiao, Qiaofang Pang, Xiyuan Yang, Yuxia Chen, Xiaoying Wu, Min Zhong, Nong Xiao, Wensheng Hou

IEEE J Biomed Health Inform. 2025 Nov 26. Online ahead of print.

Abstract

Automated annotation of electronic medical records for patients with cerebral palsy (CP) is crucial for downstream clinical applications. However, most existing methods lack mechanisms to verify model predictions before their acceptance and suffer from labeled data scarcity. To address this challenge, we propose a Deep Cooperative Learning for Automated Annotation (DCLA) framework. DCLA integrates named entity recognition (NER) and relation extraction (RE) models that employ the multi-head attention mechanism and the global pointer to handle complex entities and relations. Building on this foundation, a cooperative learning (CL) mechanism is introduced to evaluate prediction quality through score matrices for sample ranking and selection. Low-quality predictions are verified by annotators, while high-quality predictions are accepted automatically, enabling iterative retraining with cooperatively labeled data. Experiments on a CP-specific corpus demonstrate that DCLA's NER and RE models outperform state-of-the-art methods, while the CL mechanism enhances proofreading efficiency. Overall, DCLA enhances proofreading efficiency, mitigates data scarcity, and supports continuous model refinement.

PMID: [41296966](#)

26. Family-centered care for children with cerebral palsy: A meta-analysis of perspectives from children, caregivers, and professionals through the measure of processes of care

Laura Ares-Brage, Caritat Bagur-Calafat, Marta Amor-Barbosa, Cristina Lidón-Moyano, Rita-Pilar Romero-Galisteo

J Child Health Care. 2025 Nov 25. Online ahead of print.

Abstract

Children with cerebral palsy (CP) and their families face a wide range of healthcare services. Evidence suggests that this care should be family-centered (FCC). The purpose of this systematic review and meta-analysis was to gather the existing evidence about the experience of children with CP, families, and professionals with FCC through the Measure of Processes of Care (MPOC) and analyze the different perspectives in the population groups, determining which aspects of this model are more entrenched and which need special attention to improve. A search of the peer-reviewed literature in five databases was conducted. The included studies were assessed using the relevant Joanna Briggs Institute tool and a meta-analysis was performed. Fifteen articles were included, in which any version of the MPOC was used for both families and professionals. However, no article reporting the experience of children was found. The domains related to "Information provided" were the lowest rated by families and professionals, so special attention should be paid to this. The highest average score was for "Respectful care," both families and professionals agree that the treatment provided is characterized by respect and dignity. Recommendations are provided to start collecting this kind of information for children with CP.

PMID: [41288187](#)

27. Iatrogenic Botulism Following Botulinum Toxin Injection in a Child With Cerebral Palsy: A Case Report

Selcan Öztürk, Serap Tomruk Sütbeyaz, Hüseyin Per

J Child Neurol. 2025 Nov 24. Online ahead of print.

Background: Botulinum toxin is widely used for the treatment of spasticity in pediatric patients with cerebral palsy.

Although regarded as safe, rare but severe systemic complications, such as iatrogenic botulism, may arise.

Case Presentation: We present the case of an 8-year-old boy with cerebral palsy who experienced global muscle weakness, bilateral ptosis, dysphagia, and respiratory distress after botulinum toxin A (Dysport). The clinical presentation was consistent with iatrogenic botulism. The patient was administered botulinum antitoxin, resulting in a gradual enhancement of the condition. Sequential clinical photos depict the progression of the sickness and subsequent recovery, which led to progressive improvement.

Conclusion: Iatrogenic botulism must be contemplated in individuals exhibiting new-onset bulbar or respiratory symptoms after botulinum toxin injection. Timely identification and prompt commencement of antitoxin treatment are essential for positive outcomes.

PMID: [41284652](#)

28. Reliability and Stability of Cerebral Palsy Classification Scales for Individuals with STXBP1 Related Disorders and SYNGAP1 Related Disorders

Samuel R Pierce, Julie M Orlando, Kristin G Cunningham, Sarah M Ruggiero, Jillian L McKee, Ingo Helbig

medRxiv [Preprint]. 2025 Nov 6.

Aim: To determine the interrater reliability and stability of the Gross Motor Function Classification System (GMFCS), mini-Manual Ability Classification System (mini-MACS), Manual Ability Classification System (MACS), and Communication Function Classification System (CFCs) in individuals with STXBP1-Related Disorder (STXBP1-RD) and SYNGAP1-Related Disorder (SYNGAP1-RD).

Methods: Data were collected from 83 individuals with STXBP1-RD (mean age = 9.8 years) and 101 individuals with SYNGAP1-RD (mean age = 10.9 years). Two raters completed the GMFCS, MACS/MiniMACS, and CFCs assessments on the same day, and test-retest stability was evaluated for participants with two longitudinal assessments.

Results: Interrater agreement varied from 73.8% to 77.3% for the STXBP1-RD cohort and from 60.5% to 83.3% for the SYNGAP1-RD cohort. Interrater reliability weighted kappa scores for the STXBP1-RD cohort varied from 0.83 to 0.93 while the SYNGAP1-RD cohort ranged from 0.66–0.81. Test-retest stability scores for the STXBP1-RD group varied from 0.62 to 0.94 while the SYNGAP1-RD group ranged from 0.38 to 0.78. Significant correlations were found between all assessment scales for both STXBP1-RD (Kendall's Tau range from 0.25–0.42) and SYNGAP1-RD (Kendall's Tau range from 0.19–0.45).

Interpretation: The GMFCS, MACS/MiniMACS, and CFCs demonstrate appropriate levels of interrater reliability and stability for individuals with STXBP1-RD and SYNGAP1-RD.

What this paper adds: Classification tools are reliable and stable in individuals with *STXBP1* -RD and *SYNGAP1* -RD.

Gross motor function is least affected for both conditions. Language function is most affected for both conditions.

Correlations are decreased compared to children with cerebral palsy due to phenotype differences.

PMID: [41282913](#)

29. Recessive genomic and phenotypic variation in consanguineous families with cerebral palsy

Pritha Bisarad, Yung-Chun Wang, Peter T Skidmore, Carolina I Galaz-Montoya, Sara A Lewis, Bader Alhaddad, Nahyun Kong, Dominic Julian, Helen Magee, Tyler N Kruer, Yuhan Xie, Wangjie Zheng, Boyang Li, Fatemeh V Rajabpour, James Liu, Anjali Revanur, Khadijah Bakur, Saghar Ghasemi Firouzabadi, Sarina Sharbatkhori, Abbas Tafakhori, Ehsan Taghiabadi, Ermia Nezaminargabad, Shohreh Vosoogh, Javad Jamshidi, Serajaddin Arefnia, Seyed Ahmad Hosseini, Alireza Khajehmirzaei, Faezeh Jamali, Azadeh Ahmadifard, Hamidreza Khodadadi, Parvaneh Daneshmand, Saeed Bohlega, Sateesh Maddirevula, Seba Saleh Nadeef, Mais O Hashem, Mustafa A Salih, Inaam N Mohamed, Heinrich Sticht, Sara Peres Morias, Joana Damásio, Mariana Santos, José Leal Loureiro, Rita Rodrigues, Giovanni Stevanin, Mehdi Benkirane, Benjamin Dauriat, Nicholas Head, Júlia Baptista, Saeid Shahhosseini, Farhan Mohammad, Hongyu Zhao, Sergio Padilla-Lopez, Fowzan Alkuraya, Somayeh Bakhtiari, Michael C Kruer, Sheng Chih Jin, Hossein Darvish

medRxiv [Preprint]. 2025 Nov 6.

Abstract

Cerebral palsy (CP) is a neurodevelopmental disorder of motor function, with genetic etiologies, particularly de novo variants, identified in approximately one-third of cases. The contribution of consanguinity—long-recognized as a CP risk factor—has remained undefined. Here, we report findings from 188 primarily consanguineous Middle Eastern families with CP and identified putative causative genes in nearly three-quarters. The majority demonstrated recessive inheritance, although multi-level consanguinity and multilocus pathogenic variants complicated Mendelian assortment analyses. We identified 110 known CP-associated genes—five with phenotypic expansions and three others exhibiting new recessive inheritance patterns—and 24 novel candidates. We characterized ten candidates as high-confidence based on independent replication and protein modeling. We experimentally validated a role for SUCO variants in CP and newly identified a role for mid-gestational migrating excitatory neurons in the disorder. These findings highlight new genes, pathways, and phenotypes that reveal striking genomic diversity in CP.

PMID: [41282771](#)

Prevention and Cure

30. Benefits and risks of antenatal corticosteroids

Thomas Schmitz

Gynecol Obstet Fertil Senol. 2025 Nov 26. Online ahead of print.

Abstract

Antenatal administration of a single course of corticosteroids before 34 weeks of gestation is associated in the neonatal period with a significant reduction of respiratory distress syndrome (RDS), intraventricular hemorrhage (IVH), necrotizing enterocolitis (NEC) and death, and possibly in childhood with a reduction of cerebral palsy and increased psychomotor development index and intact survival. However, this treatment could be associated with insulin resistance in adulthood and with an increase in mental and behavioural disorders as well as more infections in childhood when birth finally occurs at term. Because of a favourable benefit/risk ratio, antenatal administration of a single course of corticosteroids is recommended for women at risk of preterm delivery before 34 weeks. Repeated antenatal corticosteroid administration is associated in the neonatal period with respiratory benefits but dose-dependent decreased birth weight and, in childhood, with possible neurological impairment. Therefore, this strategy is not recommended. There are two possible strategies for improving the benefit/risk ratio of treatment: reducing the dose or improving the timing of administration. Although it was not possible in a French trial to demonstrate the non-inferiority of a 50% dose reduction on the occurrence of severe RDS, survival without severe neonatal morbidity after half-dose was identical to that after full-dose. The results of further trials and follow-up of these children are therefore required before any conclusions can be drawn about dose reduction.

Strategies to improve the timing of treatment have never been evaluated. In conclusion, antenatal corticosteroid administration is recommended to every woman at risk of preterm delivery before 34 weeks of gestation. Strategies aimed at improving the benefit/risk ratio of this treatment are still being evaluated.

PMID: [41314337](#)

31. Five-year outcomes after cooling for hypoxic-ischemic encephalopathy and predictive value of aEEG

Dorian Blommaert, Arend F Bos, Anne E den Heijer, Hendrik J Ter Horst

Early Hum Dev. 2025 Nov 24;213:106455. Online ahead of print.

Background: Therapeutic hypothermia (TH) is standard practice for neonatal hypoxic-ischemic encephalopathy (HIE). Persistently abnormal amplitude-integrated electroencephalography (aEEG) background patterns are associated with adverse outcomes. We aimed to determine neurodevelopmental outcomes at age five and the predictive value of aEEG. **Study design:** We studied infants with HIE treated with TH between 2013 and 2018. At age five, we assessed motor (neurological examination, movement-ABC) and cognitive outcomes. We classified children as developing typically (IQ \geq 85 and M-ABC $>$ p16), mildly abnormal (IQ 70-84 and/or cerebral palsy with GMFCS 1-2 and/or M-ABC \leq p16), and severely abnormal (IQ $<$ 70 and/or cerebral palsy GMFCS $>$ 2). During the first 96 h after birth, we assessed aEEG background patterns and presence of seizures.

Results: Out of 95 infants 14 (15%) died and we lost 18 (22%) survivors to follow-up. At age five, 33 (52%) were developing typically, 21 (33%) mildly abnormal, and 9 (14%) severely abnormal. A severely abnormal aEEG at 48 h was the best predictor for death/severely abnormal outcome with a PPV of 88%, and a PPV of 71% for severe disability in survivors. Children with death/severely abnormal outcomes had electrographic seizures more frequently and a higher seizure burden than children developing typically/mildly abnormal (61% vs 11%, $P < .001$, median 40 vs 0 min, $P < .001$). Absence of electrographic seizures was highly predictive (NPV 92%) of typical/mildly abnormal outcome in survivors.

Conclusion: Among survivors, five-year outcomes after TH were favorable. aEEG background patterns at 48 h and seizure burden were reliable predictors of five-year outcomes.

PMID: [41313920](#)

32. Concurrent Validity and Inter-Rater Reliability of the Motor Optimality Score-Revised in a Neonatal Surgical Population

Cathryn Crowle, Michelle Jackman, Carly Luke, Annabel Webb, Michelle Juarez, Larissa Korostenski, Katya Zawada, Remy Blatch-Williams, Catherine Morgan

J Clin Med. 2025 Nov 10;14(22):7953.

Objectives: This study aims to evaluate the concurrent validity and inter-rater reliability and agreement of the Motor Optimality Score-Revised (MOS-R) in infants following major surgery in the neonatal period.

Methods: A cross-sectional study of 211 term infants (mean GA 37.85 weeks, SD 2.10) with congenital anomalies requiring neonatal surgery assessed the concurrent validity of the MOS-R with the Bayley III and HINE at 3 months. Inter-rater reliability and agreement were determined using Gwet's Agreement Coefficient (AC1), the intraclass correlation coefficient (ICC), and percentage agreement (%).

Results: There were 209 infants assessed at 11-16 weeks post-term age (mean 13 weeks, SD 1.21), and a very weak correlation was observed between MOS-R and Bayley III for cognition ($p = 0.02$), expressive communication ($p = 0.04$), and gross motor ($p < 0.001$). When the MOS-R was categorised based on optimality, the only association was gross motor ($p < 0.002$). The MOS-R had a very weak correlation with the HINE total score (0.18, $p < 0.001$). The inter-rater reliability for the total MOS-R was substantial (AC1 = 0.72). When the MOS-R was categorised as optimal, mildly reduced, moderately reduced, or severely reduced, we found good levels of agreement between raters (AC1 = 0.76, 83% agreement). Perfect agreement (AC1 = 1.00, 100%) was found for categorising the MOS-R using a predictive cut score for adverse outcomes (<23 vs. ≥ 23).

Conclusions: At three months of age, the MOS-R showed weak associations with the HINE and Bayley III, indicating limited concurrent validity. Despite this, all tools offer valuable clinical insights. The inter-rater reliability for the MOS-R was good for categorising the MOS-R based on optimality and excellent when using a predictive cut-off score.

PMID: [41302989](#)

33. Cumulative Hydrocortisone Exposure and Early Brain Volumetrics in Very Low Birth Weight Infants: Associations with Neurodevelopmental Outcomes

Min Soo Kim, Moon-Yeon Oh, Emi Tomita, Soo-Ah Im, Young-Ah Youn, Sae Yun Kim

Biomedicines. 2025 Nov 12;13(11):2765.

Background/Objectives: Systemic hydrocortisone (HCS) in very low birth weight (VLBW) infants is commonly used to treat early hypotension or prevent bronchopulmonary dysplasia. This study evaluated the associations between postnatal HCS exposure and neurodevelopment in VLBW infants by comparing regional brain volume at term-equivalent age (TEA) with neurodevelopmental outcomes in early infancy.

Methods: This retrospective cohort study included VLBW infants admitted to a neonatal intensive care unit (NICU) between 2013 and 2019. The cumulative HCS dose during hospitalization was recorded, and regional brain volumes were analyzed using magnetic resonance imaging at TEA. Neurodevelopmental outcomes were assessed at a corrected age for prematurity of 18-24 months.

Results: Among 146 infants, 57 were classified in the high HCS group (>90 mg/kg) and 89 in the low HCS group (≤ 90 mg/kg HCS). Bronchopulmonary dysplasia, periventricular leukomalacia, and sepsis were more frequent in the high HCS group. Ninety-five infants underwent magnetic resonance imaging, which revealed reduced brain volumes in the high HCS group. At follow-up, cerebral palsy (35.9% vs. 9.1%, $p = 0.003$), neurodevelopmental impairment (54.0% vs. 23.6%, $p = 0.002$), and head circumference <10 th percentile (64.3% vs. 19.5%, $p < 0.001$) were more common in the high HCS group. After adjustment, HCS >90 mg/kg remained independently associated with cerebral palsy (adjusted odds ratio [aOR] 5.44, $p = 0.016$) and reduced head circumference (aOR 4.45, $p = 0.016$).

Conclusions: High cumulative HC exposure correlated with reduced brain volume at TEA and adverse neurodevelopmental outcomes at 24 months of age. Careful monitoring of dose and treatment duration is essential to balance therapeutic benefits against potential risks.

PMID: [41301858](#)

34. Early motor and cognitive development in typically developing children and those with or at high risk of cerebral palsy: A scoping review

No authors listed

Dev Med Child Neurol. 2025 Nov 24. Online ahead of print.

Abstract

No abstract available.

PMID: [41287466](#)

35. Urinary metabolome at birth in patients with hypoxic-ischemic encephalopathy treated with therapeutic hypothermia and long-term neurodevelopmental outcomes: a 7-year follow up

Claudio Ancona, Enrico Valerio, Nicoletta Mainini, Alessio Favali, Ignazio D'Errico, Chiara Lasagni, Matteo Stocchero, Paola Pirillo, Giuseppe Giordano, Stefano Sartori, Eugenio Baraldi

J Transl Med. 2025 Nov 24;23(1):1345.

Background: Hypoxic-ischemic encephalopathy (HIE) is a leading cause of neonatal mortality and morbidity, yet no validated biomarkers currently exist to predict long-term outcomes. We investigated the potential of the neonatal urinary metabolomic profile as a predictor of long-term neurodevelopmental outcomes in HIE newborns treated with therapeutic hypothermia (TH).

Methods: We conducted a longitudinal study in neonates with HIE undergoing TH. Urine samples collected during TH were analyzed using untargeted metabolomics via mass spectrometry. Based on long-term follow-up outcomes, patients were categorized into two groups: the adverse outcome (AO) group, defined by perinatal death, cerebral palsy, and/or an intelligence quotient (IQ) <70, and the favourable outcome (FO) group, defined as absence of CP and IQ ≥70. Additionally, we assessed the predictive value of early neonatal brain magnetic resonance imaging (MRI) in relation to the aforementioned outcomes.

Results: Among 53 newborns treated with TH for HIE, long-term follow-up outcomes were available for 40; 29 were classified as FO and 11 as AO group. To mitigate bias, 11 FO patients were matched with 11 AO patients based on similar perinatal characteristics. Metabolomic analysis identified 21 metabolites distinguishing the two groups, with γ -butyrolactone, N-acetyl-galactosamine/glucosamine, Aldosterone, and Creatinine showing independent discriminative capability among groups. Brain MRI demonstrated a 67% positive and 96% negative predictive value for adverse outcomes.

Conclusions: The identified metabolites are implicated in neuromodulation and neuronal susceptibility to damage, suggesting their potential as prognostic markers for long-term outcomes in HIE and warranting further investigation. This is the first study linking the acute-phase metabolomic profile with long-term neurodevelopmental outcomes in HIE neonates, supporting its prognostic potential.

PMID: [41286887](#)

36.Reduction of IVH in very preterm infants via a two-step quality improvement project: a retrospective study of 14 years' experience

Jochen Essers, Manuel Boris Bryant, Cornelia Horsch, Benedikt Winter, Frank Reister, Benjamin Mayer, Harald Ehrhardt, Helmut D Hummler

Arch Dis Child Fetal Neonatal Ed. 2025 Nov 24. Online ahead of print.

Objective: The introduction of quality improvement projects has been reported to be associated with a reduced rate of intraventricular haemorrhage (IVH) rate in some neonatal intensive care units.

Methods: In this retrospective single-centre study of 1675 preterm infants <1500 g, we analysed the frequency of overall IVH and severe IVH before and after the introduction of a first (2010) and a second (2019) quality improvement bundle.

Results: After the introduction of a first bundle of interventions in 2010, we were able to show a significant reduction of the rate of IVH from 22.2% to 10.5% ($p=0.002$), mainly related to a reduction of severe IVH in the subgroup of infants below 26 weeks of gestational age. By continuous monitoring and implementation of a second intervention bundle in 2019 according to new identified risk factors, we could maintain a low rate of IVH over a 14 year period. With the reduction of the IVH rate, we observed improved long-term neurodevelopmental outcome as indicated by a lower rate of cerebral palsy and improved psychomotor development scores.

Conclusion: Our data suggest that implementing an intervention bundle of measures targeted to avoid risk factors may be associated with a significant reduction in IVH rate. By constant monitoring of the effects of the intervention and individual measures and refining the care bundle based on new evidence becoming available, a reduced IVH rate may be maintained despite annual fluctuations in the incidence of IVH. These intensified efforts are justified as IVH is not an inevitable event.

PMID: [41285560](#)