Cerebral palsy research news

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Interventions and Management

1.Feasibility study on the application of HD-sEMG-based force estimation technology in the assessment of hand dysfunction in cerebral palsy

Xinlu Zhang, Kun Wang, De Wu, Xu Zhang, Xiang Chen

Front Bioeng Biotechnol . 2025 Apr 2:13:1580098. doi: 10.3389/fbioe.2025.1580098. eCollection 2025.

Introduction: In response to the demand for a quantifiable means for assessing hand dysfunction in cerebral palsy (CP), this paper proposed and conducted a novel high-density (HD)-surface electromyography (sEMG)-based muscle force estimation framework.
Methods and results: A highly generalized source network was developed firstly based on long short-term memory (LSTM) networks and three different healthy adult HD-sEMG-force datasets, achieving a root mean square error (RMSE) of 6.31% in force estimation across various force modes; Then, transfer learning techniques were applied to fine tune the well-trained source network using data from healthy children, establishing five gesture-specific target networks that achieved RMSE below 10% in force estimation tasks independent of the subjects; Finally, a muscle force estimation experiment was conducted on 16 children with CP using the gesture-specific target networks.
Conclusion: By comparing and analyzing the experimental results of CP group and healthy control group, CP children with different grades of Manual Ability Classification System (MACS), and CP children with different types of symptoms, it was verified that the abnormal EMG-force relationship obtained using the proposed muscle force estimation scheme had the potential for clinical application in the assessment of CP hand dysfunction. Muscle force estimation based on sEMG has broad application prospects in clinical practice. The research work in this paper has important value in promoting the clinical application of muscle force estimation technology based on sEMG, which is conducive to improving the quantitative assessment level of motor dysfunction.
PMID: 40242354

2.Knee surveillance for ambulant children with cerebral palsy

Pam Thomason, Kerr Graham, Ken Ye, Annette O'Donnell, Vedant Kulkarni, Jon R Davids, Erich Rutz

J Child Orthop . 2025 Apr 15:18632521251330448. doi: 10.1177/18632521251330448. Online ahead of print.

Purpose: A majority of ambulant children with cerebral palsy (CP) develop progressive musculoskeletal pathology (MSP) during growth. Fixed flexion deformity at the knee joint (FFDKn) contributes to flexed knee gait and is prone to relapse after index multi-level surgery. This perspective introduces the concept of "knee surveillance" (KS), defined as a repeated systematic assessment of gait and knee range of motion until skeletal maturity. KS aims to detect early FFDKn, allowing for early intervention with minimally invasive techniques such as anterior distal femur hemiepiphysiodesis (ADFH), and reduce the need for higher-risk surgery such as distal femoral extension osteotomy (DFEO) and patellar tendon shortening (PTS).
Methods: Recent literature on the assessment of ambulant children with CP, consensus statements on indications for dose-based knee surgery, and the indications for ADFH have been reviewed and synthesized. These provide a preliminary evidence base for the concept of KS in ambulant children with CP.
Conclusion: We propose the concept of KS for ambulant children with CP. The goals of KS are early detection of knee flexion deformity, early intervention, less invasive surgery, and better long-term outcomes. There is preliminary evidence to suggest that soft-tissue surgery, in combination with ADFH, can reduce, or perhaps replace, the need for more invasive surgery such as DFEO and PTS.
PMID: 40248438

3.Development of ankle and knee range of motion after isolated gastrocsoleus lengthening in children with cerebral palsy: a register-based longitudinal cohort study

Olof Lindén, Henrik Lauge-Pedersen, Gunnar Hägglund, Philippe Wagner

Acta Orthop . 2025 Apr 17:96:331-338. doi: 10.2340/17453674.2025.43387.

Background and purpose: Outcome after gastrocsoleus lengthening in cerebral palsy (CP) is reported to be influenced by type of lengthening, age, CP subtype, and preoperative range of motion (ROM). We examined the development of ankle and knee ROM after 3 types of isolated gastrocsoleus lengthening.
Methods: This is a register-based longitudinal cohort study based on data from the Swedish Cerebral Palsy follow Up Program, of children born 2000-2011 who underwent isolated gastrocsoleus lengthening. ROM development was analyzed using mixed-effects modeling. Event limits were defined as ankle ROM ≤ 0° or ≥ 20° and knee extension deficit ≤ -10° and described in Kaplan-Meier curves and Cox regression analyses. The study protocol was published at clinicaltrials.gov.
Results: 184 children were included. The mean differences in ankle ROM 10 years postoperatively between open tendo Achilles lengthening (OTAL) and percutaneous tendo Achilles lengthening (PTAL) was -2.3° (95% confidence interval [CI] -7.4 to 2.7), and between gastrocnemius lengthening (GCL) and PTAL -4.4° (CI -10.4 to 1.5). The adjusted hazard ratio (aHR), adjusted for baseline ROM, Gross Motor Function Classification System level, and CP subtype, comparing ankle event rates between OTAL and PTAL was 2.5 (CI 1.1-5.7). GCL was also associated with a higher event rate compared with PTAL, aHR 2.0 (CI 0.85-4.6). The adjusted mean difference in knee ROM at 10 years between OTAL and PTAL was 5.1° (CI 0.4-9.8), and between GCL and PTAL 1.9° (CI -3.6 to 7.6). Comparing event rates for the knee yielded uncertain results.
Conclusion: PTAL appears at least as effective as OTAL and GCL for favorable ankle and knee ROM development in children with CP.
PMID: 40242883

4.Quality of Life after Deep Brain Stimulation: A primary versus secondary dystonia comparative study

Emily Sanrey, Marylou Grasso, Marie Brethome, Emilie Chan-Seng, Valérie Gil, Philippe Coubes, Gaëtan Poulen

Stereotact Funct Neurosurg . 2025 Apr 11:1-12. doi: 10.1159/000545755. Online ahead of print.

Introduction: Generalized dystonia is a motor disorder causing major limitations in daily living activities. Deep brain stimulation (DBS) is an established therapy for primary disorders, but its efficacy in secondary ones remains variable. Although quality of life (QoL) assessment is crucial in disabling conditions to understand the comprehensive impact of surgical treatment on daily life, the available questionnaires are not well adapted.
Methods: Herein, QoL after DBS was evaluated using a "homemade" scale. The DBS-QoL scale is a new questionnaire specifically designed for generalized dystonia patients.
Results: Twenty-one DYT1 patients and 40 cerebral palsy patients underwent GPi-DBS during the inclusion period. Clinical improvement was measured using the BFMDRS and compared to QoL evolution using the DBS-QoL. We identified a significant positive impact of DBS on motor and functional aspects for both groups, with superior gains in DYT1 patients. In this group, we found significant improvement in functional aspects, whereas in perinatal hypoxic patients, the opposite trend was reported, with better satisfaction in terms of wellbeing. Across both etiologies, patients expressed satisfaction with the surgical outcomes (83%).
Conclusion: QoL assessment, using a dedicated scale, was shown to complement BFMDRS, enhancing the detection of subtle symptom improvements in DBS-treated patients.
PMID: 40222351

5.A core outcome set to assess chronic pain interference and impact on emotional functioning for children and young people with cerebral palsy

Nadine L Smith, Noula Gibson, Christine Imms, Ashleigh L Thornton, Adrienne R Harvey

Dev Med Child Neurol. 2025 Apr 16. doi: 10.1111/dmcn.16325. Online ahead of print.

Aim: To: (1) develop a core outcome set (COS) to assess chronic pain interference and impact on emotional functioning for children and young people with cerebral palsy (CP) with varying communication, cognitive, and functional abilities; (2) categorize the assessment tools according to reporting method or observer-reported outcome measures; and (3) categorize the content of tools in the COS according to the International Classification of Functioning, Disability and Health (ICF).
Method: A two-stage multi-stakeholder consensus process was used: stage 1 consisted of a workshop where 42 valid and reliable assessment tools were presented to 12 clinicians and six individuals with lived experience of CP to exclude tools considered not feasible; stage 2 consisted of a 2-round Delphi survey of 85 clinicians, researchers, and individuals with lived experience of CP to gain consensus on which tools to include. Included tools were mapped to the framework of the ICF.
Results: Twenty of 29 chronic pain assessment tools considered feasible reached 75% or greater consensus for inclusion in the COS. The tools were categorized according to reporting type: patient-reported or observer-reported; and their purpose: to identify the presence of chronic pain, to assess pain interference on activities of daily living, or to assess the impact on emotional functioning.
Interpretation: The developed COS guided the assessment of pain interference and impact on emotional functioning for children and young people with CP with a range of communication and cognitive abilities; the COS can be used to facilitate patient-centred care.
PMID: 40241234

6.From childhood to adulthood: Long-term assessment of continuous intrathecal baclofen therapy in non-ambulant spastic cerebral palsy

B H M Martens, M Iskander, D L Soudant, G F Vles, L A Bonouvrié, O P M Teernstra, J S H Vles, R J Vermeulen

Eur J Paediatr Neurol . 2025 Apr 12:56:17-23. doi: 10.1016/j.ejpn.2025.04.002. Online ahead of print.

Background: knowledge about lasting effects of continuous intrathecal baclofen (CITB) therapy during development into adulthood in non-ambulant individuals with cerebral palsy (CP) is limited.
Aim: we assessed individual goals including ease of care, pain reduction, at long term. Also, we aimed to gauge burden of CITB through hospitalization rates, orthopedic surgeries, pump-related complications, pump refills, and satisfaction levels among individuals and caregivers.
Methods: a prospective cohort of 17 individuals with CP (pump implantation 2002-2005) was assessed in 2022. Visual Analogue Scale (VAS) scores, Child Health Questionnaire Parent Form-50 (CHQ-PF50), and a Likert-scale questionnaire, were employed. Data was gathered through interviews with individuals or caregivers.
Results: fifteen individuals were alive at initial follow-up (mean age 31.8 years). Statistically significant improvements in VAS scores for individual goals, ease of care, and pain observed six months post-therapy initiation persisted into adulthood. Mental health and change in health decreased back to baseline at long-term follow-up, other domains of quality in life did not differ significantly. Treatment-related hospital admission was one per 3.6 years, of which 13.2 % were due to complications. The number of patients with scoliosis increased during the years. Despite, the majority (80 %) expressed continued preference for CITB treatment.
Conclusion: improvements of CITB on domains of body function, activities and social participation, and quality of life persist into adulthood. Although there are some side effects of CITB therapy, both patients and their caregivers report high satisfaction.
PMID: 40239388

7.Glycopyrrolate for Drooling in Children With Neurodisability: Multicenter Study

Pinar Ozbudak, Habibe Koc Ucar, Leman Tekin Orgun, Kivilcim Gucuyener

J Child Neurol . 2025 Apr 15:8830738251330414. doi: 10.1177/08830738251330414. Online ahead of print.

Abstract
Objective This multicenter study aimed to evaluate the efficacy and safety of oral glycopyrrolate in children with neurodisabilities experiencing moderate-to-severe drooling. Methods A total of 159 children diagnosed with cerebral palsy, epileptic encephalopathy, or autism spectrum disorder were assessed using the Drooling Impact Scale, Drooling Severity and Frequency Scale, and quality of life measures at baseline, week 4, and week 12. A structured dose titration protocol was followed, and adverse events were systematically recorded. Results Of the 159 children enrolled, 130 completed the study. Significant improvements were observed in Drooling Impact Scale, Drooling Severity and Frequency Scale, and quality of life scores across all groups ($P < .001$). Cerebral palsy patients exhibited greater variability in Drooling Impact Scale scores than epileptic encephalopathy and autism spectrum disorder groups at weeks 4 and 12 ($P < .01$). Adverse effects were predominantly mild, with constipation being the most common. Conclusion Glycopyrrolate is an effective and well-tolerated treatment for drooling in children with neurodisabilities, including autism spectrum disorder and epileptic encephalopathy. It presents a viable pharmacologic option for improving salivary control and quality of life.
PMID: 40232683

8.Neuronal responses in the human primary motor cortex coincide with the subjective onset of movement intention in brain-machine interface-mediated actions

Jean-Paul Noel, Marcie Bockbrader, Tommaso Bertoni, Sam Colachis, Marco Solca, Pavo Orepic, Patrick D Ganzer, Patrick Haggard, Ali Rezai, Olaf Blanke, Andrea Serino

PLoS Biol. 2025 Apr 17;23(4):e3003118. doi: 10.1371/journal.pbio.3003118. eCollection 2025 Apr.
Abstract
Self-initiated behavior is accompanied by the experience of intending our actions. Here, we leverage the unique opportunity to examine the full intentional chain-from intention to action to environmental effects-in a tetraplegic person outfitted with a primary motor cortex (M1) brain-machine interface (BMI) generating real hand movements via neuromuscular electrical stimulation (NMES). This combined BMI-NMES approach allowed us to selectively manipulate each element of the intentional chain (intention, action, effect) while probing subjective experience and performing extra-cellular recordings in human M1. Behaviorally, we reveal a novel form of intentional binding: motor intentions are reflected in a perceived temporal attraction between the onset of intentions and that of actions. Neurally, we demonstrate that evoked spiking activity in M1 largely coincides in time with the onset of the experience of intention and that M1 spike counts and the onset of subjective intention may co-vary on a trial-by-trial basis. Further, population-level dynamics, as indexed by a decoder instantiating movement, reflect intention-action temporal binding. The results fill a significant knowledge gap by relating human spiking activity in M1 with the onset of subjective intention and complement prior human intracranial work examining pre-motor and parietal areas.
PMID: 40244939

9.Use of the Pediatric Evaluation of Disability Inventory - Computer Adaptive Test in Denmark, the Netherlands, and Norway

Tea Nørgaard Hansen, Karl Bang Christensen, Michelle Stahlhut, Marjolijn Ketelaar, Gunvor Lilleholt Klevberg, Louise Bolvig Laursen, Mette Røn Kristensen, Reidun Jahnsen, Tina Hansen

Dev Med Child Neurol. 2025 Apr 18. doi: 10.1111/dmcn.16324. Online ahead of print.

Aim: To investigate whether the items of the Danish, Dutch, and Norwegian versions of the Pediatric Evaluation of Disability Inventory - Computer Adaptive Test (PEDI-CAT) align with the location-order used in the original algorithm and to assess their structural validity.
Method: Three convenience samples without disability (0-20 years; Danish [n = 318], Dutch [n = 349], Norwegian [n = 362]) responded to the language-specific versions. Item location-order was estimated using the graded response model and structural validity was tested using confirmatory factor analysis and Rasch analysis.
Results: For most items, the item location-order was largely consistent with the location-order used in the original PEDI-CAT algorithm. Items showing a different order were primarily related to the daily activity domain. However, the confirmatory factor analysis and Rasch analysis indicated poor model fit, multidimensionality, and local dependency. Additionally, the Rasch analysis revealed that some items were misfitting, with a few also showing signs of misfit in the original PEDI-CAT version. Few items displayed differential item functioning by sex.
Interpretation: The Danish, Dutch, and Norwegian version of the PEDI-CAT can be used to measure the degree of functioning or responsibility. However, clinicians should interpret the PEDI-CAT results with caution due to evidence of multidimensionality, some misfit items, and differential item functioning by sex. Further research is warranted in a population of children and young people with disabilities.
PMID: 40249747

10.Quality of cerebral palsy videos on Chinese social media platforms

Wenjie He, Dongning Tang, Ya Jin, Wenyan Zhang, Yunyun Kang, Qing Xia

Sci Rep. 2025 Apr 17;15(1):13323. doi: 10.1038/s41598-024-84845-8.

Abstract
A significant research gap exists in evaluating the prevalence and quality of Chinese videos depicting CP on domestic social media platforms. In contrast to studies that focus on online video content concerning CP on YouTube, CP videos on YouTube are largely inaccessible to average citizens in mainland China. This disparity underscores the need for further investigation into the availability and nature of CP videos specifically on Chinese social media platforms. To assess the reliability and quality of short videos related to cerebral palsy (CP) on Chinese social media platforms. The present cross-sectional study examined 344 videos about CP from popular Chinese social media platforms, including TikTok, Kwai, Weibo, Bilibili, and RED. The analysis of these videos involved a detailed assessment of their sources, content, and characteristics. Additionally, quantitative scoring tools such as journal of the American medical association (JAMA) benchmarks, gobal quality score (GQS), and DISCERN were utilized to evaluate video quality. Furthermore, the potential relationship between video quality and various attributes such as duration, number of likes, and comments was explored and their impact on the quality of information presented in the videos was analyzed. The average duration of the 344 videos was 92.12 s (SD 105.69). CP rehabilitation training videos comprised 45.64% of the total, followed by expert-contributed videos at 40.70%. Mean scores for JAMA, GQS, and DISCERN were 1.62 (SD 0.60), 2.05 (SD 0.99), and 1.26 (SD 1.26) respectively. RED had the lowest average scores. Videos focusing on disease knowledge scored highest on JAMA and GQS scales. Experts achieved significantly higher GQS and DISCERN scores compared to health-related institutions and amateurs. Spearman correlation analysis revealed a strong positive correlation between likes and comments ($r = .0.87$, $P < .0.001$). Enhancing the management of medical content is crucial to address the compromised reliability of Chinese online short videos providing information to families of CP patients. Improving content professionalism and accuracy ensures users access genuinely valuable information.
PMID: 40246856

11.Interdisciplinary care in the rehabilitation process of children and adolescents with cerebral palsy in Argentina

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Arch Argent Pediatr . 2025 Apr 17:e202410551. doi: 10.5546/aap.2024-10551.eng. Online ahead of print.

Objective. To compare the differences between the characteristics of rehabilitation processes (dosage and interdisciplinary care) and the clinical and sociodemographic characteristics of children and adolescents with cerebral palsy (CP) attending rehabilitation centers in Argentina. Population and methods. This is a cross-sectional study with sequential sampling. Children and adolescents aged 2 to 19 with CP from 15 rehabilitation centers were included. Questionnaires and information from medical records were used. The chi-square test with Fisher or Man-Whitney correction was used to compare the differences between the response variables (dose and interdisciplinary care) with age, severity, social security, type of institution, and socioeconomic level (SEL). A bivariate analysis with odds ratio was performed to measure the magnitude of the association. Results. A total of 267 participants were included. In terms of dose, the median was 3.5 hours of therapy per week. Children of lower-middle SEL, without social security, and attending public institutions received fewer hours of therapy. No differences were found in the number of hours according to age and severity level; regarding the number of disciplines, in most children older than 11 years fewer disciplines were involved in the therapeutic process. Conclusion. Statistically significant differences in dosing and interdisciplinary care were found concerning age groups, SES, access to social security, and type of institution attended, but not with the level of motor impairment.
PMID: 40237373

12.A Survey of Health Care Professionals Regarding Transition in Cerebral Palsy in the South East England

Susie Turner, Charlotte Nash, Jane Goodwin, Johanna Smith, Charlie Fairhurst, Jill Cadwgan

J Eval Clin Pract . 2025 Apr;31(3):e70078. doi: 10.1111/jep.70078.

No abstract available
PMID: 40222038

13.Integrated metabolomics and proteomics analysis in children with cerebral palsy exposed to botulinum toxin-A

Zhaofang Chen, Tingting Peng Sr, Mengru Zhong, Yage Zhang, Yuan Zhang, Qingfen Hou, Tingting Peng Jr, Xubo Yang, Hongyu Zhou, Liru Liu, Mingshan Han, Hongmei Tang, Lu He, Jinling Li, Huiran Niu, Kaishou Xu

Pediatr Res. 2025 Apr 17. doi: 10.1038/s41390-025-04038-5. Online ahead of print.

Background: We previously examined plasma metabolic changes before and after botulinum toxin-A injections of cerebral palsy (CP) children and showed that the glycine, serine and threonine metabolism may play a key role in neuritogenesis. This study analysed untargeted metabolomics combined with proteomics of plasma to discussed which substances are meaningfully changed, to what extent they affect the effects of action.
Methods: Blood samples were collected from 91 children with spastic CP at 4 time points: pre-injection (T1), 1 month post-injection (T2), 3 months post-injection (T3) and 6 months post-injection (T4). Differentially changed metabolites and proteins were selected, and co-expression pathways were constructed to explore the key molecular processes.
Results: A total of 674 proteins and 354 metabolites were identified. The differential metabolites were mainly involved in the linoleic acid metabolism, beta-Alanine metabolism, citrate cycle, pyruvate metabolism and glycolysis or gluconeogenesis. Differential proteins were primarily associated with glucose metabolism, lipid metabolism, immune and inflammation responses. Co-expression pathways showed that ECM-receptor interaction, complement and coagulation cascades, glycolysis or gluconeogenesis, pyruvate metabolism, and linoleic acid metabolism were the main pathways.
Conslusions: Our results indicated the botulinum toxin-A predominantly activated the glucose metabolism, lipid metabolism, and immune and inflammation responses, and energy metabolism changed significantly in this process.
Trial registration details: ChiCTR2000033800, Research on the mechanism of botulinum toxin relieving spasticity in children with cerebral palsy. Approval No. 202023041. Registered 13 June 2020, http://www.chictr.org.cn/showproj.html?proj=52267 .
Impact statement: This is the first study that combined dynamic metabolomics and proteomics analysis to investigate the molecular changes in children with spastic cerebral palsy after botulinum toxin-A injections, which might provide a theoretical reference for the further subsequent study for targets to increase the efficacy and prolong the duration of botulinum toxin-A, and would be a valuable resource for the metabolomics and proteomics field in this group.
PMID: 40247116

14.Upregulating mTOR/S6 K Pathway by CASTOR1 Promotes Astrocyte Proliferation and Myelination in Gpam-/--induced mouse model of cerebral palsy

Zhaofang Chen, Liru Liu, Xiaolin Guo, Yage Zhang, Mengru Zhong, Yi Xu, Tingting Peng Sr, Tingting Peng Jr, Yuan Zhang, Qingfen Hou, Danxia Fan, Ting Gao, Lu He, Hongmei Tang, Hao Hu, Kaishou Xu

Mol Neurobiol . 2025 Apr 15. doi: 10.1007/s12035-025-04901-w. Online ahead of print.

Abstract
GPAM, a key enzyme for lipid synthesis, is predominantly expressed in astrocytes (ASTs), where it facilitates lipid supply for myelin formation. Our previous studies identified GPAM as a novel causative gene for cerebral palsy (CP) and led to the development of a CP mouse model with GPAM deficiency (Gpam-/-). The model closely recapitulated the clinical phenotype of children with CP, due to the restricted proliferation of ASTs in the brain, reduced the amount of lipid, thinner brain white matter, and myelin dysplasia. The mammalian target of rapamycin (mTOR) pathway plays an important role in cell proliferation and lipid synthesis. Cytosolic arginine sensor (CASTOR1) interacts with GATOR2 to regulate mTOR complex 1 (mTORC1). Targeted degradation of CASTOR1 can activate the mTOR pathway. However, it remains unclear the involvement of mTOR pathway in neurological diseases such as CP. In this study, we demonstrated that the mTOR pathway was inhibited in Gpam-/- mice. Notably, CASTOR1 could regulate the activity of mTOR/S6K pathway, functioning as a negative upstream regulator. Furthermore, inhibition of CASTOR1 upregulated mTOR/S6K signaling, promoting astrocyte proliferation and myelination, which in turn enhanced motor function in the Gpam-/--induced CP mouse model. Collectively, these findings reveal the role of astrocytic mTOR in the pathogenesis of CP mice, broaden the therapeutic strategies, and provide a promising candidate target for CP treatment.
PMID: 40234290