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Cerebral palsy research news

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Interventions and Management

1. Psychometric properties of functional postural control tests in children: A systematic review
Charlotte Johnson, Ann Hallemans, Mieke Goetschalckx, Pieter Meyns, Eugene Rameckers, Katrijn Klingels, Evi Verbecque

Review Ann Phys Rehabil Med. 2023 Jan 18;66(4):101729. doi: 10.1016/j.rehab.2022.101729. Online ahead of print.

Background: Postural control deficits are one of the most common impairments treated in pediatric physiotherapeutic practice. Adequate evaluation of these deficits is imperative to identify postural control deficits, plan treatment and assess efficacy. Currently, there is no gold standard evaluation for postural control deficits. However, the number of studies investigating the psychometric properties of functional pediatric postural control tests has increased significantly. Objective: To facilitate the selection of an appropriate pediatric functional postural control test in research and clinical practice. Methods: Systematic review following the PRISMA guidelines. PubMed, Web of Science and Scopus were systematically searched (last update: June 2022; PROSPERO: CRD42021246995). Studies were selected using the PICOs-method (pediatric populations (P), functional assessment tools for postural control (I) and psychometric properties (O). The risk of bias was rated with the COSMIN checklist and the level of evidence was determined with GRADE. For each test, the postural control systems were mapped, and the psychometric properties were extracted. Results: Seventy studies investigating 26 different postural control tests were included. Most children were healthy or had cerebral palsy. Overall, the evidence for all measurement properties was low to very low. Most tests (95%) showed good reliability (ICC>0.70), but inconsistent validity results. Structural validity, internal consistency and responsiveness were only available for 3 tests. Only the Kids-BESTest and FAB covered all postural control systems. Conclusion: Currently, 2 functional tests encompass the entire construct of postural control. Although reliability is overall good, validity results depend on task, age and pathology. Future research should focus on test batteries and should particularly explore structural validity and responsiveness in different populations with methodologically strong study designs.

PMID: 36669385

2. Quantitative assessment of trunk movements in functional reaching in children and adolescents with dyskinetic cerebral palsy
Ellen Van Wonterghem, Inti Vanmechelen, Helga Haberfehlner, Bieke Decrock, Elegast Monbaliu

Clin Biomech (Bristol, Avon). 2023 Jan 5;102:105876. doi: 10.1016/j.clinbiomech.2023.105876. Online ahead of print.

Background: Trunk control and upper limb function are often disturbed in people with dyskinetic cerebral palsy. While trunk control is fundamental in upper limb activities, insights in trunk control in dyskinetic cerebral palsy are missing. This study aimed to determine trunk movement characteristics in individuals with dyskinetic cerebral palsy during reaching. Methods: Twenty individuals with dyskinetic cerebral palsy (MACS level I-III (16y6m)) and 20 typical developing peers (17y2m) were

included. Participants performed three tasks: reach forward, reach sideways, and reach and grasp vertically, using a cross-sectional study design. Movements were analyzed using 3D motion capture and a sensor on the trunk. Trunk range of motion, joint angle at point of task achievement, peak and range of angular velocity and linear acceleration were compared between groups using Mann-Whitney U and independent t-tests. Findings: Participants with dyskinetic cerebral palsy showed higher trunk range of motion in all planes during reach forward and reach and grasp vertically, and in rotation and lateral flexion during reach sideways. During reach and grasp vertically, the joint angle at point of task achievement differed in the transversal plane. Ranges of angular velocity and linear acceleration were higher for all tasks and planes for participants with dyskinetic cerebral palsy, and for peak values in nearly all planes. Interpretation: Current results provide insights in trunk control at population level. This is a first step towards a better and individualized evaluation and treatment for trunk control, being an important factor in improving functional activities for individuals with dyskinetic cerebral palsy.

PMID: 36640748

3. [Relationship between the gross motor function classification system and hip and lumbar spine development in children with spastic cerebral palsy][Article in Chinese]
Gang Liu, Li Liu, Lin Xu, Chao Ma, Bo-Wen Deng, Sheng-Yuan Jiang, Rui-Qin Yu, Yi Zhao, Xiao-Hong Mu

Zhongguo Gu Shang. 2023 Jan 25;36(1):79-85. doi: 10.12200/j.issn.1003-0034.2023.01.015.

Objective: To investigate the relationship among the gross motor function classification system (GMFCS)and the development of hip joint and lumbar spine in children with spastic cerebral palsy. Methods: The clinical data of 125 children with spastic cerebral palsy admitted from January 2018 to July 2021 were retrospectively analyzed. There were 85 males and 40 females, aged from 4 to 12 years old with an average of (8.4±2.9) years. According to GMFCS, the patients were divided into grade Ⅰ, Ⅱ, Ⅲ and Ⅳ groups. There were 27 cases in grade Ⅰ group, 40 cases in grade Ⅱ group, 35 cases in grade Ⅲ group and 23 cases in grade Ⅳ group. The migration percentage(MP), central edge angle(CE), neck-shaft angle(NSA), acetabular index(AI) were measured by the radiograph of pelvis, abnormal parameters were selected to evaluate the relationship between different GMFCS grades and hip joint development. Lumbar sagittal Cobb angle, lumbar sacral angle, lumbar lordosis index and apical distance were measured by lateral lumbar radiographs to evaluate the relationship between different GMFCS grades and lumbar spine development. Results: □Among the 125 spastic cerebral palsy children, there were 119 cases of pelvic radiographs that met the measurement standards. In the four groups with grade Ⅰ, Ⅱ, Ⅲ, Ⅳ, MP was (22.72±3.88), (26.53±4.36), (33.84±4.99), and (49.54±7.87)%, CE was(30.10±6.99) °, (22.92±4.19) °, (17.91±5.50) °, and (-0.70±17.33)°, AI was (16.41±2.77) °, (20.46±4.63) °, (23.76±5.10) °, and (29.15±7.35)°, respectively, there were significant differences between the two comparisons (P<0.05). And the higher GMFCS grade, the greater MP and AI, and the smaller CE.The NSA was(142.74±10.03) °, (148.66±9.09) °, (151.66±10.52) °, and (153.70±8.05)° in four groups with grade Ⅰ, Ⅱ, Ⅲ, Ⅳ, respectively. The differences between the two comparisons of the GMFCS grade Ⅰ group and the other three groups were statistically significant (P<0.05). NSA of GMFCS Ⅰ group was significantly lower than that of the others, there was no significant difference among other groups(P>0.05). □ Among the 125 spastic cerebral palsy children, there were 88 cases of lumbar spine radiographs that met the measurement standards. □The lumbar sagittal Cobb angle was(32.62±11.10) °, (29.86±9.90) °, (31.70±11.84) °, and (39.69±6.80)° in the four groups with grade Ⅰ, Ⅱ, Ⅲ, Ⅳ, respectively;GMFSS of grade Ⅳ group was significantly higher than that of other three groups, there was significant difference between the two comparisons (P<0.05);there were no significant differences between other groups (P>0.05). In the four groups with grade Ⅰ, Ⅱ, Ⅲ, Ⅳ, the lumbosacral angle was (31.02±9.91) °, (26.57±9.41) °, (28.08±8.56) °, and (27.31±11.50)°, the lumbar lordosis index was (4.14±12.89), (8.83±13.53), (13.00±11.78), and (10.76±9.97) mm, the arch apex distance was (9.50±6.80), (6.68±3.20), (7.16±4.94), and (6.62±4.13) mm, respectively, there were no significant differences between the two comparisons(P>0.05). Conclusion: □In children with GMFCS grade Ⅰ-Ⅳ, the higher the GMFCS grade, the worse the hip develops. □ Children with GMFCS grade Ⅲ-Ⅳ may be at greater risk for lumbar kyphosis.

PMID: 36653012

4. Does intrathecal baclofen therapy decrease the progression of hip displacement in young patients with cerebral palsy?
Ali Asma, Armagan Can Ulusaloglu, Jason J Howard, Kenneth J Rogers, Maura McManus, Freeman Miller, M Wade Shrader

Dev Med Child Neurol. 2023 Jan 17. doi: 10.1111/dmcn.15509. Online ahead of print.

Aim: To evaluate the effects of intrathecal baclofen pump (ITBP) therapy on hip dysplasia in young patients with cerebral palsy (CP). Method: This was a retrospective cohort series of prospectively collected data. Inclusion criteria were all patients with CP in Gross Motor Function Classification System (GMFCS) levels IV or V who underwent ITBP placement under 8 years old with at least 5 years of follow-up. Thirty-four patients were matched to a control group of 71 patients based on GMFCS level, motor type, medical comorbidities, worst hip migration percentage at ITBP placement, age, and Modified Ashworth scale scores. Patients were followed for at least 5 years or until they had hip reconstructive surgery. The primary outcome was the development of hip displacement as measured by the migration percentage at the latest follow-up or the preoperative migration percentage before hip reconstruction. Results: The migration percentage at last follow-up was not statistically different between groups (ITBP: 36.2%, non-ITBP: 44.4%, p = 0.14). The rates of future preventative, reconstructive, and recurrent hip surgery were not different between groups. Interpretation: The use of ITBP as an early treatment of spasticity did not alter the natural history of progressive hip displacement in non-ambulatory patients with CP and hip displacement is likely multifactorial, not solely due to spasticity.

PMID: 36649172

5. Comparison of the six-minute walk test performed over a 15 and 30 m course by children with cerebral palsy
Joanna Krasny, Marek Jozwiak, Elisabet Rodby-Bousquet

BMC Musculoskelet Disord. 2023 Jan 17;24(1):34. doi: 10.1186/s12891-022-05944-z.

Background: The aim of this study was to compare performance on the six-minute walk test (6MWT) performed over 15 m and 30 m courses by children and youths with cerebral palsy (CP). Methods: Children and youths with CP at Gross Motor Function Classification System levels I-IV performed the 6MWT in a straight 15 m-long corridor (first trial) and 30 m-long corridor (second trial). The intraclass correlation coefficient (ICC) and Bland-Altman plots were used to evaluate the agreement between the 6MWT results for the two corridor lengths. Results: We included 82 children and youths with CP (36 girls, 46 boys), with a mean age of 11.7 years (SD 4.2, range 5-22 years). There was high agreement between the results of the two 6MWTs: ICC 0.93 (95% confidence interval 0.76-0.97). The total walking distance was longer for the 30 m course (median 399 m, range 44-687 m) than the 15 m course (median 357 m, range 24-583 m). Conclusions: We observed good agreement for the performance of the 6MWT in the 15 m and 30 m courses, although the total walking distance was greater for the 30 m course. We recommend that the same distance is used when evaluating changes in walking ability for an individual child. Both distances are appropriate when measuring endurance in children and youths with CP.

PMID: 36650438

6. Haemodynamics and oxygenation in the lower-limb muscles of young ambulatory adults with cerebral palsy
Ronit Aviram, Inbar Kima, Yisrael Parmet, Haim Bassan, Thierry Willigenburg, Raziel Riemer, Simona Bar-Haim

Dev Med Child Neurol. 2023 Jan 16. doi: 10.1111/dmcn.15508. Online ahead of print.

Aim: To evaluate muscle haemodynamics and oxygen metabolism in adults with cerebral palsy (CP) at rest and during exercise. Method: This cross-sectional study included 12 adults with spastic CP (four females, eight males; mean age [SD] 29 years 6 months [7 years 10.8 months]) and 13 typically developing individuals (seven females, six males; mean age [SD] 26 years 6 months [1 year 1.9 months]). Near-infrared spectroscopy was used to assess changes in muscle blood flow (mBF), muscle oxygen consumption (mVO2), and muscle oxygen saturation in the vastus lateralis and rectus femoris muscles during three conditions: rest, low load at 20% maximum voluntary contraction (MVC), and high load at 80% MVC. Results: MBF was lower in participants with CP than in typically developing participants at rest ($p < 0.001$) and at 20% MVC ($p = 0.007$) in both muscles. Increased load caused a reduction in mBF in typically developing participants and an increase in CP. MVO2 in typically developing participants increased from rest to 20% MVC and was reduced at 80% MVC compared with 20% MVC. In participants with CP, there was no change with load in the rectus femoris muscle; however, there was an increase in the vastus lateralis muscle from rest to 20% MVC, and 80% MVC had a similar value. Muscle saturation was higher in participants with CP across all conditions (vastus lateralis, $p < 0.001$; rectus femoris, $p = 0.0518$). Interpretation: Oxidative metabolism in CP is not limited by oxygen delivery (mBF), because high muscle saturation suggests oxygen availability. Adults with CP demonstrate muscular responses to exercise that are inconsistent with typical high-workload activation, probably because of inefficient fibre recruitment and secondary anomalies.

PMID: 36646638

7. A Case Series Evaluating Postoperative Complications of Foot and Ankle Surgeries in Adult Patients With Neuromuscular Disease
Joshua Levine, Sophia Mavrommatis, Sandy Vang, Sarah Anderson

Foot Ankle Orthop. 2023 Jan 13;8(1):24730114221148165. doi: 10.1177/24730114221148165. eCollection 2023 Jan.

Background: Patients with neuromuscular diseases such as cerebral palsy (CP) are living longer because of advances in medicine, yielding a larger number of adult patients that could benefit from corrective surgery. However, some surgeons are hesitant to offer surgery to these patients because of concern for postoperative complications. A paucity of literature exists that describes complications in patients undergoing foot and ankle surgery for neuromuscular diseases. The primary study outcome was to identify the postoperative complication rates associated with foot and ankle surgery in adult patients with neuromuscular disease. Methods: The charts of patients with neuromuscular diseases who had foot and ankle surgery by the senior author at a single institution from March 2010 to March 2020 were reviewed. Patient charts were reviewed for demographic data, medical history and diagnoses, and surgical treatment information. Only patients' index procedures with the senior author were evaluated for surgical data. Patient charts were assessed to determine the presence or absence of a postoperative complication following an index procedure. Results: In a cohort of 42 patients, females comprised 60% of the patient cohort. The average age was 35 (range, 20-69) years old. CP was the most common neuromuscular diagnosis at 52% (22 of 42) patients. Eighteen percent (11 of 60) of the index surgeries had 1 or more complication with a total of 13 complications. The overall wound complication rate was 10% (6 of 60), infection rate was 8% (5 of 60), and the nonunion rate following arthrodesis was 10% (2 of 21). Conclusion: We conclude that foot and ankle surgery in this complex population can be done safely, with postoperative complication rates similar to the average population. Although these patients may present with unique challenges, surgeons should not forgo surgery out of concern for postoperative complications. Level of evidence: Level IV, retrospective cohort study at a single institution.

PMID: 36654886

8. White matter microstructure and receptive vocabulary in children with cerebral palsy: The role of interhemispheric connectivity
Olga Laporta-Hoyos, Kerstin Pannek, Alex M Pagnozzi, Simona Fiori, Roslyn N Boyd

PLoS One. 2023 Jan 17;18(1):e0280055. doi: 10.1371/journal.pone.0280055. eCollection 2023.

Background: Communication and cognitive impairments are common impediments to participation and social functioning in children with cerebral palsy (CP). Bilateral language networks underlie the function of some high-level language-related cognitive functions. Purpose: To explore the association between receptive vocabulary and white-matter microstructure in the temporal lobes and the central part of the temporo-temporal bundles in children with CP. Materials and methods: 37 children with spastic motor type CP (mean age 9.6 years, 25 male) underwent a receptive vocabulary test (Peabody Picture Vocabulary Test, PPVT-IV) and 3T MRI. Mean fractional anisotropy (FA) and mean diffusivity (MD) were calculated for the temporal lobes and the interhemispheric bundles traversing the splenium of the corpus callosum and the anterior commissure. Associations between microstructure and receptive vocabulary function were explored using univariable linear regression. Results: PPVT-IV scores were significantly associated with mean white matter MD in the left temporal lobe, but not the right temporal lobe. There was no association between PPVT-IV and mean white matter FA in the temporal lobes. PPVT-IV scores were not significantly associated with the laterality of these diffusion tensor metrics. Within the corpus callosum, FA, but not MD of the temporo-temporal bundles was significantly associated with the PPVT-IV scores. Within the anterior commissure no equivalent relationship between diffusion metrics and PPVT-IV was found. Conclusion: Our findings add further understanding to the pathophysiological basis underlying receptive vocabulary skills in children with CP that could extend to other patients with early brain damage. This study highlights the importance of interhemispheric connections for receptive vocabulary.

PMID: 36649231

9. Exploring caregiver and participant experiences of the Program for the Education and Enrichment of Relational Skills (PEERS®) for youth with acquired brain injury and cerebral palsy
Rose Gilmore, Jenny Ziviani, Sarah McIntyre, Sarah Goodman, Zephanie Tyack, Leanne Sakzewski

Disabil Rehabil. 2023 Jan 20;1-9. doi: 10.1080/09638288.2023.2167008. Online ahead of print.

Purpose: This study explored the experience of adolescents with brain injuries and their caregivers who participated in the Program for the Education and Enrichment of Relational Skills (PEERS®) in Australia. Materials and methods: Twenty-seven adolescents and 31 caregivers, who completed the PEERS® intervention as part of an RCT, contributed to focus groups following the 14-week program. Semi-structed interviews guided focus groups. An interpretive description methodology was used to understand participants' experiences in the program and suggestions for improvements. Results: Thematic analysis led to the development of five themes. "Challenging families and meeting expectations" explored the challenge and worth of participating. "Learnt new skills" highlighted skills and strategies gained and methods used to achieve these. "Connecting, belonging and understanding that's our normal" represented the value placed on the group experience. "Confidence in knowing and doing" reflected the changes in everyday social experiences and "Where to from here?" provided many suggestions for adaptation to improve practice. Conclusion: After taking part in the PEERS® social skills group intervention, most adolescents with brain injury and their caregivers perceived improvement in their social participation and had suggestions for improving the group experience. Some adolescents didn't enjoy the program. IMPLICATIONS FOR REHABILITATION: Offering adolescents with brain injury and their caregivers the opportunity to participate in a group social skills intervention is an important part of paediatric rehabilitation. Participants of group social skills interventions are likely to perceive improvements in their everyday social functioning following completion. Considering strategies to enhance engagement in the group is expected to be important for outcomes. Participants of group social skills programs may need additional support and adjustments to balance the demands of the intervention with other everyday family and school tasks and requirements.

PMID: 36661096

10. Evaluation of a computer game-assisted rehabilitation program for manual dexterity of children with cerebral palsy: Feasibility randomized control trial
Anuprita Kanitkar, Sanjay Tejraj Parmar, Tony Joseph Szturm, Gayle Restall, Gina Ruth Rempel, Nariman Sepehri, Nilahri Naik

PM R. 2023 Jan 19. doi: 10.1002/pmrj.12947. Online ahead of print.

Introduction: There is a need for innovation to improve the engagement and compliance of rehabilitation programs for children with upper extremity (UE) motor impairments due to Cerebral Palsy (CP); a computer games-based rehabilitation platform (GRP) was developed to address this need. The GRP provides engaging task-specific exercises targeting manual dexterity (object handling and manipulation). Objective: An exploratory randomized clinical trial was conducted to evaluate the therapeutic value and treatment effect size of an exercise program using the GRP in children with CP. Methods: A total of sixty -three children with CP, aged 4 to 10 years, were recruited. The Peabody Developmental Motor Scale-2 (PDMS-2) Grasp and Visual-Motor Integration subscores and Computer game-based Upper Extremity (CUE) assessment of manual dexterity was used to assess participants before and after a 16-week intervention program, delivered three times per week. The experimental group (XG) received a computer games-based exercise program targeting object manipulation tasks. The active control arm (CG) consisted of task-specific training similar to the tasks used in constrained induced movement therapy. Results: There were only a few dropouts during the 16-week program, and compliance was high. Both groups showed significant improvements with medium to large effect sizes. Improvements in the PDMS-2 Grasp and VMI subscores observed in the XG were significantly greater than that in the CG. There was a significant improvements ($p<0.01$) in PDMS-2 grasp and VMI subscores for XG with moderate to large effect sizes, (0.5-0.8). For CG, the Grasp and VMI subscores did improve but these changes were not statistically significant. There was a significant improvement observed in the majority of CUE object manipulation test scores for XG ($p<0.01$) with moderate to large effect sizes (0.50-1.2) Although CG did show improvements in all CUE object manipulation test scores the changes did not reach statistical significance ($p<0.01$). Conclusion: This study demonstrates the utility of the GRP to practice a broad range of object manipulation tasks in children with CP. The present findings are positive and support further research and development. The long-term effects of the GRP program in children with CP will need to be confirmed in a future randomized controlled trial. In addition to measures of structure and function, future RCT should also include outcome measures such as health-related quality of life and level of participation to validate the findings.

PMID: 36655404

11. The effects of functional electrical stimulation cycling on gait parameters in diplegic cerebral palsy: a single-blind randomized controlled trial
Duygu Türker, Yavuz Yakut, Evren Yaşar, Mintaze Kerem Günel, Bilge Yılmaz, Arif Kenan Tan

Somatosens Mot Res. 2023 Jan 16;1-10. doi: 10.1080/08990220.2022.2157393. Online ahead of print.

Purpose: To investigate the effects of functional electrical stimulation cycling (FES-C) training in addition to conventional physical therapy on gait, muscle strength, gross motor function, and energy expenditure in ambulatory children with spastic diplegic cerebral palsy. Materials and methods: Twenty children with diplegic cerebral palsy were randomly assigned to FES-C group (n = 10) or control group (n = 10). Subjects trained 3 days/week for 8 weeks. Control group received conventional physical therapy. The FES-C group additionally received FES-C training. The functional muscle test was used for muscle strength assessment. Vicon-3D system was used for gait analysis. Gross Motor Function Measure (GMFM-88) was used for motor function assessment and calorimeter was used for energy expenditure. Measurements were performed at the baseline, at the eight week and at the sixteenth week. Results: Functional muscle strength, gross motor function, and energy expenditure improved more in the FES-C group after training and follow up ($p < 0.05$). There was no significant difference found between the changes in gait parameters of the two groups after treatment and follow up ($p > 0.05$). Pelvic tilt while walking decreased after training in the FES-C group ($p < 0.05$). Conclusions: FES-C applied in addition to conventional physical therapy in children with diplegic cerebral palsy is more effective than conventional physical therapy for increasing functional muscle strength, improving gross motor function functions, and reducing energy expenditure.HighlightsFES-C improves lower extremity functional muscle strength, gross motor function, and energy expenditure in ambulatory children with spastic dCP.The use of FES-C in combination with conventional physiotherapy methods may be beneficial in outpatients with spastic dCP.

PMID: 36645809

12. A randomized, cross-over trial comparing the effect of innovative robotic gait training and functional clinical therapy in children with cerebral palsy; a protocol to test feasibility
Anna M McCormick, Hana Alazem, Sarah Zaidi, Nicholas J Barrowman, Leanne M Ward, Hugh J McMillan, Patricia Longmuir, Michelle Larin, Kathryn Dalton

Contemp Clin Trials. 2023 Jan 17;107086. doi: 10.1016/j.cct.2023.107086. Online ahead of print.

Purpose: Robotic gait training is relatively new in the world of pediatric rehabilitation. Preliminary feasibility studies and case reports have only recently included stationary robot-assisted treadmill training. Mobile robotic gait trainers hold greater promise for intensive practice-based therapy within hospitals, schools, rehabilitation centers, and at-home therapy as they enable participation and social integration while practicing high-quality gait patterns. Materials and methods: This paper (clinical trials registry number: NCT05378243) provides a detailed description of a mixed-method cross-over trial design with a broad set of outcome measures. Ultimately the goal is to establish the feasibility of this design which includes the collection of qualitative data regarding patient, family, and therapist experience and quantitative data regarding gait efficiency and quality, impact on tone, individualized goal achievement and bone strength.

PMID: 36669727

13. Early Biomarkers in the Prediction of Later Functional Impairment in Term Children with Cerebral Palsy
Samantha Eisman, Nafisa Husein, Darcy Fehlings, John Andersen, Maryam Oskoui, Michael Shevell; Canadian Cerebral Palsy Registry

Pediatr Neurol. 2022 Dec 24;140:59-64. doi: 10.1016/j.pediatrneurol.2022.12.004. Online ahead of print.

Aim: To identify possible early biomarkers that could predict later functional capabilities in children at risk for cerebral palsy (CP). Methods: Data from 869 term children with CP were extracted from the Canadian Cerebral Palsy Registry. Univariate analyses were conducted to measure the association between readily available objective early biomarkers (neonatal

encephalopathy [NE], cord or first hour of life pH, magnetic resonance imaging [MRI]) and functional outcomes such as mobility and feeding status. Multivariable regressions were then modeled to study whether adding predictors would affect the strength of the observed association. Results: Patients with NE have higher odds of having an assigned Gross Motor Function Classification Score level of IV to V (prevalence ratio [PR], 2.87; 95% confidence interval [CI], 2.07 to 3.97) and are more likely to require dependent tube feeding (PR, 2.09; 95% CI, 1.12 to 3.88); this was similarly seen in patients with MRI findings of deep gray matter injury, watershed injury, near-total brain injury, and/or cortical malformation (mobility status [PR, 5.13; 95% CI, 3.73 to 7.11] and feeding status [PR, 4.87; 95% CI, 2.57 to 9.75]). Patients with cord or first hour of life pH <7 were also more likely to predict dependent mobility status (PR, 2.86; 95% CI, 1.76 to 4.69), however, not significantly more likely to predict eventual dependent feeding status (PR, 1.47; 95% CI, 0.58 to 3.32). Conclusions: This retrospective cohort study demonstrates that NE, MRI findings and cord or first hour of life pH can reliably predict later CP related functioning. These associations can be used to inform and clarify early prognosis discussions between caregivers and health professionals.

PMID: 36640520

14. Development of a Bedside Tool to Predict the Diagnosis of Cerebral Palsy in Term-Born Neonates
Amira Rouabhi, Nafisa Husein, Deborah Dewey, Nicole Letourneau, Thierry Daboval, Maryam Oskoui, Adam Kirton, Michael Shevell, Mary J Dunbar; Canadian Cerebral Palsy Registry

JAMA Pediatr. 2023 Jan 17. doi: 10.1001/jamapediatrics.2022.5177. Online ahead of print.

Importance: Cerebral palsy (CP) is the most common abnormality of motor development and causes lifelong impairment. Early diagnosis and therapy can improve outcomes, but early identification of infants at risk remains challenging. Objective: To develop a CP prognostic tool that can be applied to all term neonates to identify those at increased risk of developing CP. Design, setting, and participants: This case-control study used data from the Canadian Cerebral Palsy Registry (data collected from January 2003 to December 2019) for children with CP and the Alberta Pregnancy Outcomes and Nutrition study (mothers enrolled from May 2009 to September 2012; data extracted in 2020) for controls. There were 2771 children with CP and 2131 controls evaluated; 941 and 144, respectively, were removed for gestational age less than 37 weeks at birth, 565 with CP removed for incomplete data, and 2 controls removed for a diagnosis of CP. Data were analyzed from April to August 2022. Exposures: Potential risk factors were selected a priori based on the literature, including maternal, intrapartum, and infant characteristics. Main outcomes and measures: Diagnosis of CP, defined as a disorder of motor function due to a nonprogressive brain abnormality before age 1 year and classified by Gross Motor Function Classification System levels I to V. Results: Of 3250 included individuals, 1752 (53.9%) were male, and the median (IQR) gestational age at birth was 39 (38-40) weeks. Encephalopathy was present in 335 of 1184 infants with CP (28%) and 0 controls. The final prediction model included 12 variables and correctly classified 75% of infants, with a sensitivity of 56% (95% CI, 52-60) and specificity of 82% (95% CI, 81-84). The C statistic was 0.74 (95% CI, 71-76). Risk factors were found to be additive. A proposed threshold for screening is probability greater than 0.3, with a sensitivity of 65% (95% CI, 61-68) and specificity of 71% (95% CI, 69-73). The prognostic tool identified 2.4-fold more children with CP than would have presented with encephalopathy (odds ratio, 13.8; 95% CI, 8.87-22.65; P < .001). Conclusions and relevance: In this case-control study, a prognostic model using 12 clinical variables improved the prediction of CP compared with clinical presentation with encephalopathy. This tool can be applied to all term newborns to help select infants for closer surveillance or further diagnostic tests, which could improve outcomes through early intervention.

PMID: 36648921

15. New Screening Tool for Term-Born Infants Enables Update to the Clinical Practice Guideline for Early Diagnosis of Cerebral Palsy
Toohey Monica, Morgan Catherine, Novak Iona

JAMA Pediatr. 2023 Jan 17. doi: 10.1001/jamapediatrics.2022.5189. Online ahead of print.

No abstract available

PMID: 36648935

16. Towards functional improvement of motor disorders associated with cerebral palsy
Saranda Bekteshi, Elegast Monbaliu, Sarah McIntyre, Gillian Saloojee, Sander R Hilberink, Nana Tatishvili, Bernard Dan

Review Lancet Neurol. 2023 Jan 16;S1474-4422(23)00004-2. doi: 10.1016/S1474-4422(23)00004-2. Online ahead of print.

Cerebral palsy is a lifelong neurodevelopmental condition arising from non-progressive disorders occurring in the fetal or infant brain. Cerebral palsy has long been categorised into discrete motor types based on the predominance of spasticity, dyskinesia, or ataxia. However, these motor disorders, muscle weakness, hypotonia, and impaired selective movements should also be discriminated across the range of presentations and along the lifespan. Although cerebral palsy is permanent, function changes across the lifespan, indicating the importance of interventions to improve outcomes in motor disorders associated with the condition. Mounting evidence exists for the inclusion of several interventions, including active surveillance, adapted physical activity, and nutrition, to prevent secondary and tertiary complications. Avenues for future research include the development of evidence-based recommendations, low-cost and high-quality alternatives to existing therapies to ensure universal access, standardised cerebral palsy registers to harmonise epidemiological and clinical information, improved adult screening and check-up programmes to facilitate positive lived experiences, and phase 3 trials for new interventions.

PMID: 36657477

17. Body mass index is not suitable for assessing body composition in children with spastic cerebral palsy
Laura M Breij, Rick A H van de Ven, Raquel Y Hulst, Ana R P Smorenburg, Jan Willem Gorter, Olaf W Verschuren

Disabil Rehabil. 2023 Jan 17;1-6. doi: 10.1080/09638288.2023.2167007. Online ahead of print.

Purpose: To measure body composition by using bioelectrical impedance analysis (BIA) and body mass index (BMI) and to investigate the correlation and agreement between BMI and fat mass percentage in children with spastic Cerebral Palsy. Materials and methods: BIA was used to assess fat mass percentage and BMI was determined from body weight and height. BMI and fat mass percentage were both categorized into five categories. The association between fat mass percentage and BMI was assessed using Pearson's correlation coefficient. Agreement between BMI and fat mass percentage was investigated with weighted Cohen's kappa coefficient. Results: One hundred and three children with CP across all Gross Motor Function Classification Levels (61% boys, mean age 9 years) were included. Mean BMI was 18.3 kg/m2 and mean fat mass was 24.9%. A large inter-subject variability was found with a weak correlation between BMI and fat mass percentage in children with a BMI < 20 kg/m2. Little agreement (k = 0.299, CI 0.16-0.44) between the categorization of children based on BMI and based on fat mass percentage was found. Interpretation: The large inter-subject variability in fat mass percentage combined with little agreement between the BMI and BIA categories suggests that BMI is not a suitable measure of fat mass in children with CP. IMPLICATIONS FOR REHABILITATION: Using body mass index (BMI) and instead of fat mass percentage increases the risk of misclassifying body composition in children with spastic Cerebral Palsy. Children with a BMI < 20 kg/m2 are more at risk to be misclassified for body composition.

PMID: 36650975

18. Cerebral Palsy and bisphosphonates - and what can be learned from other types of secondary osteoporosis in children: a scoping review
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Review Acta Paediatr. 2023 Jan 16. doi: 10.1111/apa.16671. Online ahead of print.

Aim: We aimed to improve bone health management of children with Cerebral Palsy (CP) by reviewing studies investigating bisphosphonate therapy in children with CP and other types of secondary osteoporosis. Methods: We included trials on bisphosphonate treatment reporting any direct bone measurement or fracture outcome. All studies of patients with CP were included. We also included all controlled trials of children with secondary bone fragility as well as observational studies with ≥20 participants or at least three years of follow-up. Studies were assessed according to PRISMA guidelines using the RoB2-tool and the Newcastle-Ottawa Scale. Results: We reviewed 1,004 studies and found 38 eligible. Some studies were sufficiently

homogeneous to include in a meta-analysis and we found a one-year effect on lumbar spine bone mineral density (BMD) Z-score of +0.65 after oral and +1.21 after intravenous bisphosphonates in children with secondary osteoporosis. Further, data on adverse events and post-treatment follow-up were reviewed. Limitations were heterogeneity and small size of the included studies. Conclusion: Meta-analysis consistently showed significant BMD increases with bisphosphonates in children with secondary osteoporosis. Direct evidence of the effect of bisphosphonates on reducing fractures is lacking. We found no reports of long-term adverse events yet longer studies are needed.

PMID: 36644940

19. Prediction Model for Identifying Computational Phenotypes of Children with Cerebral Palsy Needing Neurotoxin Treatments
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Toxins (Basel). 2022 Dec 28;15(1):20. doi: 10.3390/toxins15010020.

Factors associated with neurotoxin treatments in children with cerebral palsy (CP) are poorly studied. We developed and externally validated a prediction model to identify the prognostic phenotype of children with CP who require neurotoxin injections. We conducted a longitudinal, international, multicenter, double-blind descriptive study of 165 children with CP (mean age 16.5 ± 1.2 years, range 12-18 years) with and without neurotoxin treatments. We collected functional and clinical data from 2005 to 2020, entered them into the BTX-PredictMed machine-learning model, and followed the guidelines, "Transparent Reporting of a Multivariable Prediction Model for Individual Prognosis or Diagnosis". In the univariate analysis, neuromuscular scoliosis ($p = 0.0014$), equines foot ($p < 0.001$) and type of etiology (prenatal > peri/postnatal causes, $p = 0.05$) were linked with neurotoxin treatments. In the multivariate analysis, upper limbs ($p < 0.001$) and trunk muscle tone disorders ($p = 0.02$), the presence of spasticity ($p = 0.01$), dystonia ($p = 0.004$), and hip dysplasia ($p = 0.005$) were strongly associated with neurotoxin injections; and the average accuracy, sensitivity, and specificity was 75%. These results have helped us identify, with good accuracy, the clinical features of prognostic phenotypes of subjects likely to require neurotoxin injections.

PMID: 36668840

20. ICF-Based simple scale for children with cerebral palsy: Application of Mokken scale analysis and Rasch modeling
Yu-Er Jiang, Dong-Mei Zhang, Zhong-Li Jiang, Xue-Jiao Tao, Min-Jun Dai, Feng Lin

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Children with cerebral palsy (CP) are faced with long-term dysfunction. The International Classification of Functioning, Disability and Health for Children and Youth (ICF-CY) has been proposed but the complicated procedure limits the feasibility of clinical application and the exploration of health degrees. This study was aimed to establish a Mokken scale based on the ICF-CY for CP, and then to estimate psychometric properties through the derived Rasch model. 150 children with CP were assessed by the categories of "b" and "d" components in the core set. The binarized data was screened by the Mokken scale analysis and utilized for generating a reliable Rasch model. The validity of the final model was checked by the correlation between person ability, Gross Motor Function Classification System (GMFCS) and total scores. Using the Mokken scale to guide Rasch modeling, we can parameterize the properties of ICF-CY and realize the simple assessment of person abilities for children with CP.

PMID: 36659872

21. Analysis of scored goals in the cerebral palsy football World Cup
Iván Peña-González, Juan F Maggiolo, Alejandro Javaloyes, Manuel Moya-Ramón

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This study aimed to report the goal patterns in cerebral palsy (CP) football for a better understanding of the performance of this para-sport. All goals (270) of the 48 2019 IFCPF World Cup matches were analysed through match reports, and 65% of them were analysed by video footage. The results showed 5.6 goals per match. Teams that scored more and conceded fewer goals correlated to a better ranking position in the championship ($r= 0.72$-0.73; $p< 0.01$). The distribution of goals scored was not biased by halves (49.3% vs 50.7%; $\chi2= 0.1$; $p= 0.88$) nor by 15-min periods (26.3% vs 23.0% vs 23.3% vs 27.4%; $\chi2= 0.5$; $p= 0.92$). In 91.7% of the matches, the team which scored the first goal went on to win the match ($\chi2= 81.5$; $p< 0.01$). FT3 players scored more goals by player ($\chi2= 22.1$; $p< 0.01$), while there were no statistical differences in the distribution of goals conceded by goalkeepers according to their sport class ($\chi2= 4.7$; $p= 0.09$). The goals were scored mainly from organized attacks (74.4%), from the penalty area (52.5%) and through individual action (51.9%). All this information could be crucial for coaches in CP football to plan their game strategies.

PMID: 36652545

22. Parental caregivers' perception of their transition from hospital to home in children with cerebral palsy who have undergone orthopedic surgery
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Purpose: Evaluate parental perception of the quality of discharge teaching, readiness for discharge, and the impact of these on post discharge coping difficulty and resource utilization in children with cerebral palsy (CP) following surgery. Design and methods: Prospective cohort study conducted from September 2017-March 2021 at a pediatric academic medical center. Demographics were collected pre-operatively. Parents completed the Readiness for Hospital Discharge Scale (RHDS) and Quality of Discharge Teaching Scale (QDTS) within four hours of discharge. Four weeks post-discharge, parents completed the Post-discharge Coping Difficulty Scale (PDCDS). Utilization of healthcare resources were extracted from the electronic health record for 90 days post-operatively. Associations among demographics, RHDS, QDTS, PDCDS and resource utilization were assessed using general linear models; PDCDS's open-ended questions were analyzed using directed content analysis. Results: 114 parental caregivers participated. Post discharge coping was significantly associated with additional resource utilization: length of stay ($p = 0.046$), readmissions ($p = 0.001$), emergency department visits ($p = 0.001$), clinic calls ($p = 0.001$) and unplanned clinic visits ($p = 0.006$). PDCDS was negatively correlated with the QDTS Quality of Teaching Delivered subscale ($r = -0.32$; $p = 0.004$) and three of five RHDS subscales: 1) Child's Personal Status ($r = -0.24$; $p = 0.02$); 2) Knowledge ($r = -0.30$; $p = 0.005$); and 3) Coping Ability ($r = -0.39$; $p < 0.001$). Four themes explicated parental coping difficulties. Conclusion: Parents experiencing coping difficulties were more likely to have difficulty managing their child's care needs at home and required additional health care resources. Practice implications: Recognizing that parents' readiness for discharge may not reflect their coping abilities post-discharge requiring nurses to coordinate pre- and post-discharge education and support services.

PMID: 36640526

23. Relationship between physical, mental fitness and associated factors: a cross-sectional study on parents of children suffering from cerebral palsy
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Objective: The workload of parents multiplies exponentially while nurturing and raising their child suffering from cerebral palsy (CP), adding to their physical and mental exhaustion. Literature review suggests very few studies have tried to assess the health condition of such parents including factors associated that might affect the outcome. The aim of the present study is to evaluate the health status of parents with respect to their physical and mental condition as well as associated factors that have a

bearing on the same. Subjects and methods: A cross-sectional survey was conducted on 157 parents (38 fathers and 119 mothers) of CP children from special schools identified in the Dakshina Kannada district, Karnataka, India. Standard tests were used to evaluate physical and mental fitness. Analysis was done using standardized statistical tools, including the Karl Pearson correlation test to evaluate the correlation between physical and mental fitness with reference to other associated factors in such cases. Results: It was observed that cardiac, muscular, and endurance were significantly weaker in mothers as compared to fathers. Among socio-economic factors, education level, economic security, income level, and duration of caregiving are significantly correlated with mental health irrespective of the parent. 35% of the mothers suffered from moderate depression, whereas 46% of the fathers suffered from volatile mood swings. Conclusions: Mothers of special-needs children have poor cardiac and musculoskeletal fitness and are likely to develop chronic diseases in the long term. Moreover, among all education levels, economic security and duration of caregiving are significant precursors, adversely affecting mental health among both parents. A family guidelines book based on the needs of such parents could be suggested to address the key issues of concern, including their physical and mental fitness, which might help in tackling several critical issues while raising such children.

PMID: 36647852