Cerebral palsy research news

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Interventions and Management

1. Association of activities of daily living and cognitive function with thickness of the upper extremity muscles in children and adults with cerebral palsy

Mitsuhiro Masaki, Yuki Uchikawa, Yuka Iizuka, Karin Sugawara , Honoka Isobe, Fuyumi Hattori, Mami Okamoto, Saki Takahashi, Emina Morohashi, Yuki Kitamura

J Med Ultrason (2001). 2023 Mar 30. doi: 10.1007/s10396-023-01292-0. Online ahead of print.

Purpose: We examined the association of activities of daily living (ADL) and cognitive function with the upper extremity muscle thickness and upper extremity range of motion (ROM) and spasticity in children and adults with cerebral palsy (CP). Methods: The subjects were 20 children and adults with CP. The ADL performed using the upper extremities and cognitive function were assessed using the self-care domain of the Pediatric Evaluation of Disability Inventory (PEDI) and the full-scale intelligence quotient (FSIQ) of the Wechsler Intelligence Scale for Children, fourth edition (WISC-IV), respectively. The WISC-IV was assessed in only seven of 20 subjects able to undergo evaluation. The thickness of the upper extremity muscles was measured using an ultrasound imaging device. Moreover, ROM and spasticity of the upper extremities were assessed using the Modified Ashworth Scale (MAS). Manual manipulation ability was also assessed using the Manual Ability Classification System (MACS). Results: Stepwise regression analysis revealed that the extensor digitorum muscle thickness and MACS level were significant and independent factors of self-care in the PEDI. Partial correlation analysis with MACS level and age as control variables showed that the FSIQ of the WISC-IV was significantly associated with the thickness of the anterior fibers of the deltoid and flexor digitorum superficialis muscles. Conclusion: Reduced ADL performed using the upper extremities is associated with decreased extensor digitorum muscle thickness rather than ROM and spasticity of the upper extremities in children and adults with CP.

PMID: 36995568

2. Anodal Contralesional tDCS Enhances CST Excitability Bilaterally in an Adolescent with Hemiparetic Cerebral Palsy: A Brief Report

Rodrigo G Delatorre, Ellen N Sutter, Samuel T Nemanich, Linda E Krach, Gregg Meekins, Timothy Feyma, Bernadette T Gillick

Dev Neurorehabil. 2023 Mar 26;1-6. doi: 10.1080/17518423.2023.2193626. Online ahead of print.

Hemiparetic cerebral palsy (HCP), weakness on one side of the body typically caused by perinatal stroke, is characterized by lifelong motor impairments related to alterations in the corticospinal tract (CST). CST reorganization could be a useful biomarker to guide applications of neuromodulatory interventions, such as transcranial direct current stimulation (tDCS), to improve the effectiveness of rehabilitation therapies. We evaluated an adolescent with HCP and CST reorganization who

demonstrated persistent heightened CST excitability in both upper limbs following anodal contralesional tDCS. The results support further investigation of targeted tDCS as an adjuvant therapy to traditional neurorehabilitation for upper limb function.

PMID: 36967533

3. Surgical Outcomes of Cerebral Palsy Patients with Scoliosis and Lumbar Hyperlordosis: A Comparative Analysis with 2-year Minimum Follow-up

Darryl Lau, Amer F Samdani, Joshua M Pahys, Firoz Miyanji, Suken A Shah, Baron S Lonner, Paul D Sponseller, Burt Yaszay, Steven W Hwang; Harms Study Group Investigators

Spine (Phila Pa 1976). 2023 Mar 30. doi: 10.1097/BRS.0000000000004655. Online ahead of print.

Study design: Retrospective review of a prospectively collected multicenter database. Objective: To compare outcomes of patients with cerebral palsy (CP) who undergo surgery for scoliosis with normal lordosis versus hyperlordosis. Summary of background data: Surgical correction of scoliosis with lumbar hyperlordosis is challenging. Hyperlordosis may confer higher perioperative morbidity, but this is not well understood. Methods: A multicenter database was queried for CP patients who underwent surgery from 2008-2017. Minimum follow-up was 2 years. Two groups were identified: lumbar lordosis <75° (NL) versus ≥ 75° (HL). Perioperative, radiographic, and outcomes were compared. Results: 275 patients were studied: 236 NL and 39 HL (-75 to -125°). Mean age was 14.1 years, and 52.4% were male. Patients with hyperlordosis had less cognitive impairment (76.9% vs. 94.0%, P=0.008) and higher CPCHILD scores (59.4 vs. 51.0, P=0.003). Other demographics were similar between the groups. Patients with hyperlordosis had greater lumbar lordosis (-90.5 vs. -31.5°, P<0.001) and smaller sagittal vertical axis (SVA) (-4.0 vs. 2.6 cm, P<0.001). Patients with hyperlordosis had greater estimated blood loss (EBL) (2222.0 vs. 1460.7 mL, P<0.001) but a similar perioperative complication rate (20.5% vs. 22.5%, P=0.787). Significant correction of all radiographic parameters was achieved in both groups. The HL group had postoperative lumbar lordosis of -68.2° and SVA of -1.0 cm. At 2-year follow-up, patients with hyperlordosis continued to have higher CPCHILD scores and gained the greatest benefit in overall quality of life measures (20.0 vs. 6.1, P=0.008). The reoperation rate was 10.2%: implant failure (3.6%), pseudarthrosis (0.7%), and wound complications (7.3%). There were no differences in reoperation rate between the groups. Conclusion: Surgical correction of scoliosis with hyperlordosis is associated with greater EBL but similar radiographic results, perioperative morbidity, and reoperation rate. Patients with hyperlordosis gained greater overall health benefits. Correction of ≥25% of hyperlordosis seems satisfactory.

PMID: 37000681

4. Quantifying States and Transitions of Emerging Postural Control for Children Not Yet Able to Sit Independently

Patricia Mellodge, Sandra Saavedra, Linda Tran Poit, Kristamarie A Pratt, Adam D Goodworth

Sensors (Basel). 2023 Mar 21;23(6):3309. doi: 10.3390/s23063309.

Objective, quantitative postural data is limited for individuals who are non-ambulatory, especially for those who have not yet developed trunk control for sitting. There are no gold standard measurements to monitor the emergence of upright trunk control. Quantification of intermediate levels of postural control is critically needed to improve research and intervention for these individuals. Accelerometers and video were used to record postural alignment and stability for eight children with severe cerebral palsy aged 2 to 13 years, under two conditions, seated on a bench with only pelvic support and with additional thoracic support. This study developed an algorithm to classify vertical alignment and states of upright control; Stable, Wobble, Collapse, Rise and Fall from accelerometer data. Next, a Markov chain model was created to calculate a normative score for postural state and transition for each participant with each level of support. This tool allowed quantification of behaviors previously not captured in adult-based postural sway measures. Histogram and video recordings were used to confirm the output of the algorithm. Together, this tool revealed that providing external support allowed all participants: (1) to increase their time spent in the Stable state, and (2) to reduce the frequency of transitions between states. Furthermore, all participants except one showed improved state and transition scores when given external support.

PMID: 36992020

5. Commentary on "Effects of Hippotherapy on Postural Control in Children With Cerebral Palsy: A Systematic Review"

Jenna Encheff, Nicole Edmonds

Pediatr Phys Ther. 2023 Apr 1;35(2):211. doi: 10.1097/PEP.0000000000001006.

No abstract available

PMID: 36989047

6. Increased muscle responses to balance perturbations in children with cerebral palsy can be explained by increased sensitivity to center of mass movement

J Willaert, G Martino, K Desloovere, A Van Campenhout, L H Ting, F De Groote

Gait Posture. 2023 Mar 23;S0966-6362(23)00071-1. doi: 10.1016/j.gaitpost.2023.03.014. Online ahead of print.

Background: Balance impairments are common in children with cerebral palsy (CP). Muscle activity during perturbed standing is higher in children with CP than in typically developing (TD) children, but we know surprisingly little about how sensorimotor processes for balance control are altered in CP. Sensorimotor processing refers to how the nervous system translates incoming sensory information about body motion into motor commands to activate muscles. In healthy adults, muscle activity in response to backward support-surface translations during standing can be reconstructed by center of mass (CoM) feedback, i.e., by a linear combination of delayed (due to neural transmission times) CoM displacement, velocity, and acceleration. The level of muscle activity in relation to changes in CoM kinematics, i.e., the feedback gains, provides a metric of the sensitivity of the muscle response to CoM perturbations. Research question: Can CoM feedback explain reactive muscle activity in children with CP, yet with higher feedback gains than in TD children? Methods: We perturbed standing balance by backward support-surface translations of different magnitudes in 20 children with CP and 20 age-matched TD children and investigated CoM feedback pathways underlying reactive muscle activity in the triceps surae and tibialis anterior. Results: Reactive muscle activity could be reconstructed by delayed feedback of CoM kinematics and hence similar sensorimotor pathways might underlie balance control in children with CP and TD children. However, sensitivities of both agonistic and antagonistic muscle activity to CoM displacement and velocity were higher in children with CP than in TD children. The increased sensitivity of balance correcting responses to CoM movement might explain the stiffer kinematic response, i.e., smaller CoM movement, observed in children with CP. Significance: The sensorimotor model used here provided unique insights into how CP affects neural processing underlying balance control. Sensorimotor sensitivities might be a useful metric to diagnose balance impairments.

PMID: 36990910

7. Neonatal treatment with fluoxetine alters locomotor activity and the cortical glial/neuron index in rats with cerebral palsy

Glayciele Leandro de Albuquerque, Raul Manhães-de-Castro, Diego Cabral Lacerda , Caio Matheus Santos da Silva Calado, André Teracio Bezerra de Morais, Diego Bulcão Visco, Francisco Machado Manhães-de-Castro, Ana Elisa Toscano

Can J Physiol Pharmacol. 2023 Mar 29. doi: 10.1139/cjpp-2022-0463. Online ahead of print.

Cerebral palsy (CP) is characterized by motor disorders, including deficits in locomotor activity, coordination, and balance. Selective serotonin reuptake inhibitors have been shown to play an important role in brain plasticity. This study investigates the effect of neonatal treatment using fluoxetine on locomotor activity and histomorphometric parameters of the primary somatosensory cortex (S1) in rats submitted to an experimental model of CP. CP was found to reduce bodyweight and locomotion parameters and also to increase the glia/neuron index in the S1. Administration of fluoxetine 10 mg/kg reduced bodyweight, impaired locomotor activity parameters, and increased the number of glial cells and the glia/neuron ratio in the S1 in rats with CP. However, treatment with fluoxetine 5 mg/kg was not found to be associated with adverse effects on locomotor activity and seems to improve histomorphometric parameters by way of minor changes in the S1 in animals with CP. These results thus indicate that experimental CP, in combination with the use of a high dose of fluoxetine (10 mg/kg), impairs locomotor and histomorphometric parameters in the S1, while treatment with a low dose of fluoxetine (5 mg/kg) averts the negative outcomes associated with a high dose of fluoxetine in relation to these parameters but produces no protective effect.

PMID: 36988145

8. Trunk Control Measurement Scale (TCMS): Psychometric Properties of Cross-Cultural Adaptation and Validation of the Spanish Version

Javier López-Ruiz, Cecilia Estrada-Barranco, Carlos Martín-Gómez, Rosa M Egea-Gámez, Juan Antonio Valera-Calero, Patricia Martín-Casas, Ibai López-de-Uralde-Villanueva

Int J Environ Res Public Health. 2023 Mar 15;20(6):5144. doi: 10.3390/ijerph20065144.

The aim of this study was to develop a Spanish Version of the Trunk Measurement Scale (TCMS-S) to analyze its validity and reliability and determine the Standard Error of Measurement (SEM) and Minimal Detectable Change (MDC) in children with Cerebral Palsy (CP). Participants were assessed twice 7-15 days apart with the TCMS-S and once with the Gross Motor Function Measurement-88 (GMFM-88), Pediatric Disability Inventory-Computer Adaptive Test (PEDI-CAT), Cerebral Palsy Quality of Life (CPQoL), and Gross Motor Classification System (GMFCS). Internal consistency was evaluated using Cronbach's alpha, and the intraclass correlation (ICC) and kappa coefficients were used to investigate the agreement between the assessments. Finally, 96 participants with CP were included. The TCMS-S showed excellent internal consistency (Cronbach's alpha = 0.95 [0.93 to 0.96]); was highly correlated with the GMFM-88 (rho = 0.816) and the "mobility" subscale of the PEDI-CAT (rho = 0.760); showed a moderate correlation with the "feeling about functioning" CPQoL subscale (rho = 0.576); and differentiated between the GMFCS levels. Excellent test-retest agreement was found for the total and subscale scores (ICC ≥ 0.94 [0.89 to 0.97). For the total TCMS-S score, an SEM of 1.86 and an MDC of 5.15 were found. The TCMS-S is a valid and reliable tool for assessing trunk control in children with CP.

PMID: 36982053

9. ACTIVE STRIDES-CP: protocol for a randomised trial of intensive rehabilitation (combined intensive gait and cycling training) for children with moderate-to-severe bilateral cerebral palsy

Leanne Sakzewski, Dayna Pool, Ellen Armstrong, Sarah Elizabeth Reedman, Roslyn N Boyd, Catherine Elliott, Iona Novak, Stewart Trost, Robert S Ware, Tracy Comans, Rachel Toovey, Mark D Peterson, Megan Kentish, Sean Horan, Jane Valentine, Sian Williams

BMJ Open. 2023 Mar 29;13(3):e068774. doi: 10.1136/bmjopen-2022-068774.

Introduction: For children with cerebral palsy (CP), who are marginally ambulant, gross motor capacity peaks between 6 and 7 years of age with a subsequent clinical decline, impacting their ability to engage in physical activity. Active Strides-CP is a novel package of physiotherapy targeting body functions, activity and participation outcomes for children with bilateral CP. This study will compare Active Strides-CP to usual care in a multisite randomised waitlist-controlled trial. Methods and analysis: 150 children with bilateral CP (5-15 years), classified in Gross Motor Function Classification System (GMFCS) levels III and IV will be stratified (GMFCS III vs IV, age 5-10 years; 11-15 years and trial site) and randomised to receive either (1) 8 weeks of Active Strides-CP two times/week for 1.5 hours in clinic and one time/week for 1 hour alternating home visits and telehealth (total dose=32 hours) or (2) usual care. Active Strides-CP comprises functional electrical stimulation cycling, partial body weight support treadmill training, overground walking, adapted community cycling and goal-directed training. Outcomes will be measured at baseline, immediately post-intervention at 9 weeks primary endpoint and at 26 weeks post-baseline for retention. The primary outcome is the Gross Motor Function Measure-66. Secondary outcomes include habitual physical activity, cardiorespiratory fitness, walking speed and distance, frequency/involvement of community participation, mobility, goal attainment and quality of life. Analyses will follow standard principles for randomised controlled trials using two-group comparisons on all participants on an intention-to-treat basis. Comparisons between groups for primary and secondary outcomes will be conducted using regression models. A within-trial cost utility analysis will be performed. Ethics and dissemination: The Children's Health Queensland Hospital and Health Service, The University of Queensland, The University of Melbourne and Curtin University Human Research Ethics Committees have approved this study. Results will be disseminated as conference abstracts and presentations, peer-reviewed articles in scientific journals, and institution newsletters and media releases.

PMID: 36990490

10. Functional Benefit and Orthotic Effect of Dorsiflexion-FES in Children with Hemiplegic Cerebral Palsy

Idan Segal, Sam Khamis, Liora Sagie, Jacob Genizi, David Azriel, Sharona Katzenelenbogen, Aviva Fattal-Valevski

Children (Basel). 2023 Mar 9;10(3):531. doi: 10.3390/children10030531.

Functional electrical stimulation of the ankle dorsiflexor (DF-FES) may have advantages over ankle foot orthoses (AFOs) in managing pediatric cerebral palsy (CP). This study assessed the functional benefit and orthotic effect of DF-FES in children with hemiplegic CP. We conducted an open-label prospective study on children with hemiplegic CP ≥ 6 years who used DF-FES for five months. The functional benefit was assessed by repeated motor function tests and the measurement of ankle biomechanical parameters. Kinematic and spatiotemporal parameters were assessed by gait analysis after one and five months. The orthotic effect was defined by dorsiflexion ≥ 0° with DF-FES at either the mid or terminal swing. Among 26 eligible patients, 15 (median age 8.2 years, range 6-15.6) completed the study. After five months of DF-FES use, the results on the Community Balance and Mobility Scale improved, and the distance in the Six-Minute Walk Test decreased (six-point median difference, 95% CI (1.89, 8.1), -30 m, 95% CI (-83.67, -2.6), respectively, $p < 0.05$) compared to baseline. No significant changes were seen in biomechanical and kinematic parameters. Twelve patients (80%) who showed an orthotic effect at the final gait analysis experienced more supported walking over time, with a trend toward slower walking. We conclude that the continuous use of DF-FES increases postural control and may cause slower but more controlled gait.

PMID: 36980089

11. Prediction of ground reaction forces and moments during walking in children with cerebral palsy

Julie Kloeckner, Rosa M S Visscher, William R Taylor, Elke Viehweger, Enrico De Pieri

Front Hum Neurosci. 2023 Mar 8;17:1127613. doi: 10.3389/fnhum.2023.1127613. eCollection 2023.

Introduction: Gait analysis is increasingly used to support clinical decision-making regarding diagnosis and treatment planning for movement disorders. As a key part of gait analysis, inverse dynamics can be applied to estimate internal loading conditions during movement, which is essential for understanding pathological gait patterns. The inverse dynamics calculation uses external kinetic information, normally collected using force plates. However, collection of external ground reaction forces (GRFs) and moments (GRMs) can be challenging, especially in subjects with movement disorders. In recent years, a musculoskeletal modeling-based approach has been developed to predict external kinetics from kinematic data, but its performance has not yet been evaluated for altered locomotor patterns such as toe-walking. Therefore, the goal of this study was to investigate how well this prediction method performs for gait in children with cerebral palsy. Methods: The method was applied to 25 subjects with various forms of hemiplegic spastic locomotor patterns. Predicted GRFs and GRMs, in addition to associated joint kinetics derived using inverse dynamics, were statistically compared against those based on force plate measurements. Results: The results showed that the performance of the predictive method was similar for the affected and unaffected limbs, with Pearson correlation coefficients between predicted and measured GRFs of 0.71-0.96, similar to those previously reported for healthy adults, despite the motor pathology and the inclusion of toes-walkers within our cohort. However, errors were amplified when calculating the resulting joint moments to an extent that could influence clinical interpretation. Conclusion: To conclude, the musculoskeletal modeling-based approach for estimating external kinetics is promising for pathological gait, offering the possibility of estimating GRFs and GRMs without the need for force plate data. However, further development is needed before implementation within clinical settings becomes possible.

PMID: 36968787

12. Effects of Intensive Versus Distributed Constraint-Induced Movement Therapy for Children With Unilateral Cerebral Palsy: A Quasi-Randomized Trial

Tien-Ni Wang, Kai-Jie Liang, Yi-Chia Liu, Jeng-Yi Shieh, Hao-Ling Chen

Neurorehabil Neural Repair. 2023 Mar 28;15459683231162330. doi: 10.1177/15459683231162330. Online ahead of print.

Background: Previous studies have compared the effectiveness of constraint-induced movement therapy (CIMT) by different training doses. However, whether the dosing schedule, that is, intensive or distributed, influences the effectiveness of CIMT in children with unilateral cerebral palsy (CP) is unknown. Objective: To investigate the effectiveness of intensive and distributed CIMT for children with unilateral CP. Methods: Fifty children with unilateral CP were assigned to intensive or distributed CIMT group with a total of 36 training hours. The intensive CIMT was delivered within 1 week, and the distributed CIMT was delivered twice a week for 8 weeks. The outcomes were the Melbourne Assessment 2, Box and Block Test, Pediatric Motor Activity Log-Revised (PMAL-R), Bruininks-Oseretsky test of motor proficiency 2, ABILHAND-Kids and Parenting Stress Index-Short Form. The intensive group was assessed at the initiation of treatment (week 0), at the end of 1 week treatment (week 1), and 8 weeks after the initiation of treatment (week 8). The distributed group was assessed at week 0 and week 8. Results: The within-group analyses demonstrated significant differences on all motor outcomes. There were no significant between-group differences at post-treatment, while the intensive CIMT demonstrated larger improvements than the distributed CIMT did on quality of use of the more-affected hand, as rated by parents on the PMAL-R at week 8. Conclusions: The 2 dosing schedules of CIMT had similar effectiveness for children with unilateral CP. The intensive CIMT yielded additional

improvement on parent rated motor quality of the more-affected hand at 8 weeks after the initiation of treatment.

PMID: 36987387

13. A Goal-Directed Program for Wheelchair Use for Children and Young People with Cerebral Palsy in Uganda: An Explorative Intervention Study

Carin Andrews, Angelina Kakooza-Mwesige, Sauba Kamusiime, Hans Forssberg, Ann-Christin Eliasson

J Clin Med. 2023 Mar 16;12(6):2325. doi: 10.3390/jcm12062325.

In this exploratory study, we investigate whether goal-directed intervention for wheelchairs can increase the activities of daily living for children and young people with cerebral palsy (CP) when implemented in rural Uganda. Thirty-two children and young people with CP (aged 3-18 years) participated in a home-visit intervention program, which included donating wheelchairs and setting individual goals. Goal achievement, frequency of wheelchair use, condition of wheelchairs, and caregivers' perspectives were collected by interviews at 6-10 month after the start of intervention and the after three years. Our result show that most wheelchairs were in good condition and frequently used after 6-10 month with 83% goal achievement (132/158 goals; mean 4.3 (range 0-7). The caregivers reported several advantages (e.g., the child being happier) and few disadvantages (e.g., poor design and durability). At the three-year follow-up, only eleven wheelchairs were still used by 23 available participants (seven deceased and two moved). The children achieved 60% of their goals (32/53 goals mean 2.9; range 1-5). This demonstrates that the goal-directed intervention program for wheelchairs can be successfully implemented in a low-income setting with a high rate of goal achievement and frequent wheelchair use, facilitating participation. However, maintenance services are crucial to obtain sustainable results.

PMID: 36983325

14. Validation and Determination of Physical Activity Intensity GT3X+ Cut-Points in Children and Adolescents with Physical Disabilities: Preliminary Results in a Cerebral Palsy Population

Carmen Matey-Rodríguez, Susana López-Ortiz, Saúl Peñín-Grandes, José Pinto-Fraga, Pedro L Valenzuela, Mónica Pico, Carmen Fiuza-Luces, Simone Lista, Alejandro Lucia, Alejandro Santos-Lozano

Children (Basel). 2023 Feb 27;10(3):475. doi: 10.3390/children10030475.

Background: Children and adolescents with disabilities engage in low levels of moderate-to-vigorous intensity physical activity (MVPA), which may create the onset of a sedentary lifestyle. In light of this, MVPA levels must be quantified with a valid tool such as accelerometry. This study aimed to: (i) analyze the accuracy of Evenson cut-points by estimating MVPA and sedentary behavior (SB) in children and adolescents with disabilities; (ii) define new equations to estimate energy expenditure (EE) with the GT3X+ accelerometer in this population and particularly in those with cerebral palsy (CP); (iii) define specific GT3X+ cut-points to estimate MVPA in those with CP. Methods: A total of 23 children and adolescents with disabilities (10 ± 3 years; 44%females) participated in the study. GT3X+-counts and oxygen uptake (VO2) were measured in four laboratory walking conditions. Results: (i) Evenson cut-points were accurate; (ii) new equations were defined to effectively predict EE; (iii) specific GT3X+ cut-points (VM ≥ 702 counts·min-1; Y-Axis ≥ 360 counts·min-1) were defined for estimating MVPA levels in children and adolescents with CP. Conclusions: The use of specific cut-points for ActiGraph GT3X+ seems to be accurate to estimate MVPA levels in children and adolescents with disabilities and, particularly, in those with CP, at least in laboratory conditions.

PMID: 36980034

15. Botulinum toxin A for the treatment of strabismus in children with neurological impairment

Betul Tugcu, Bilge Araz-Ersan, Seyhan B Özkan

Arq Bras Oftalmol. 2023 Mar 24;S0004-27492023005002301. doi: 10.5935/0004-2749.2021-0401. Online ahead of print.

Purposes: To assess the efficacy of botulinum toxin A injection in the treatment of strabismus in patients with neurological impairment and evaluate the factors associated with treatment success. Methods: The study included 50 patients with strabismus and neurological impairment. In all children, botulinum toxin injection was performed into the appropriate extraocular muscle. The relationship between demographic features, clinical characteristics, and treatment success were

analyzed. Results: In the study group, 34 patients had esotropia, and 16 patients had exotropia. As neurological problems, 36 patients had cerebral palsy, and 14 had hydrocephalus. The average follow-up period was 15.3 ± 7.3 months. The mean number of injections was 1.4 ± 0.6. The mean angle of deviation was 42.5 ± 13.2 PD before the treatment, which decreased to 12.8 ± 11.9 PD after the treatment. Successful motor alignment (orthotropia within 10 PD) was achieved in 60% of the patients. Binary logistic regression analysis revealed that esotropic misalignment and shorter duration of strabismus was significantly associated with treatment success in the study group. Patients with esotropia and lower angles of misalignment were more likely to be treated with a single injection. Conclusion: The use of botulinum toxin A for the treatment of strabismus in children with neurological impairment is a good alternative to conventional surgical therapy with a lower risk of overcorrection. The treatment outcome is better in esodeviations and shorter duration of strabismus, implying an advantage of early treatment.

PMID: 36995810

16. "I have to obey my pain" - children's experiences of pain burden in cerebral palsy

Elisabeth Rønning Rinde, Agneta Anderzén-Carlsson, Reidun Birgitta Jahnsen, Randi Dovland Andersen

Disabil Rehabil. 2023 Mar 29;1-9. doi: 10.1080/09638288.2023.2191012. Online ahead of print.

Purpose: To explore pain experiences of children with cerebral palsy, and how it influences their everyday life. Method: Fourteen children with CP between eight and seventeen years old were included, using a purposeful sampling strategy. They had different experiences of pain, and different degrees of physical and cognitive impairments. Sixteen individual semi-structured interviews were carried out, and analyzed using inductive thematic analysis. Results: Data analysis resulted in the main theme "I have to obey my pain" and four themes were identified. Experiences regarding pain varied ("My pain is mine alone"). Both pain itself and the use of cognitive strategies to cope with pain involved a mental struggle ("Pain brings me down"). The children had to make adjustments to manage their pain ("I want to participate, but I have to rest"). The most important help was to be understood, but adults also provided valuable help with interventions like stretching, medication and adjustment of activity levels ("Others can help me"). Conclusion: Pain was a determining feature in the lives of these children with CP. The wide variety of experiences and challenges emphasized the need for tailored management strategies developed together with each child and their parents. IMPLICATIONS FOR REHABILITATION. Children with cerebral palsy had varied experiences of pain, and health professionals need to tailor their pain management approaches to the individual child. Health services should offer pain education to expand children's repertoire of pain management strategies. When a child's pain influences their daily activities, health services must ensure that the school is informed of the child's situation, and able to make necessary adjustments. Health professionals should strive to include children's own descriptions whenever possible to make sure children feel heard and believed. Even children with communicative and cognitive impairments were able to self-report when necessary adjustments in the communication situation were made.

PMID: 36987867

17. Gastrointestinal conditions related to tooth wear

John P Howard, Laura J Howard, Joe Geraghty, A Johanna Leven, Martin Ashley

Br Dent J. 2023 Mar;234(6):451-454. doi: 10.1038/s41415-023-5677-0. Epub 2023 Mar 24.

Gastro-oesophageal reflux disease (GORD) is a relatively common condition that occurs in adults and less commonly in children. It develops when the reflux of stomach contents into the oesophagus causes troublesome symptoms and/or complications. Signs and symptoms include heartburn, retrosternal discomfort, epigastric pain and hoarseness, dental erosion, chronic cough, burning mouth syndrome, halitosis and laryngitis. A proportion of patients will, however, have silent reflux. Strongly associated risk factors include family history, age, hiatus hernia, obesity and neurological conditions, such as cerebral palsy. There are different treatment options which may be considered for GORD, consisting of conservative, medical and surgical therapy. Dentists should be aware of the symptoms of GORD and dental signs of intrinsic erosion indicative of possible GORD so that they can question patients about this and, if appropriate, initiate a referral to a general medical practitioner.

PMID: 36964375

18. Robot-Assisted Gait Training with Trexo Home: Users, Usage and Initial Impacts

Christa M Diot, Jessica L Youngblood, Anya H Friesen, Tammy Wong, Tyler A Santos, Benjamin M Norman, Kelly A Larkin-

Kaise, Elizabeth G Condliffe

Children (Basel). 2023 Feb 24;10(3):437. doi: 10.3390/children10030437.

Robotic gait training has the potential to improve secondary health conditions for people with severe neurological impairment. The purpose of this study was to describe who is using the Trexo robotic gait trainer, how much training is achieved in the home and community, and what impacts are observed after the initial month of use. In this prospective observational single-cohort study, parent-reported questionnaires were collected pre- and post-training. Of the 70 participants, the median age was 7 years (range 2 to 24), 83% had CP, and 95% did not walk for mobility. Users trained 2-5 times/week. After the initial month, families reported a significant reduction in sleep disturbance ($p = 0.0066$). Changes in bowel function, positive affect, and physical activity were not statistically significant. These findings suggest that families with children who have significant mobility impairments can use a robotic gait trainer frequently in a community setting and that sleep significantly improves within the first month of use. This intervention holds promise as a novel strategy to impact multi-modal impairments for this population. Future work should include an experimental study design over a longer training period to begin to understand the relationship between training volume and its full potential.

PMID: 36979997

19. Benefits of a Wearable Cyborg HAL (Hybrid Assistive Limb) in Patients with Childhood-Onset Motor Disabilities: A 1-Year Follow-Up Study

Mayumi Matsuda Kuroda, Nobuaki Iwasaki, Hirotaka Mutsuzaki, Kenichi Yoshikawa, Kazushi Takahashi, Tomohiro Nakayama, Junko Nakayama, Ryoko Takeuchi, Yuki Mataki, Haruka Ohguro, Kazuhide Tomita

Pediatr Rep. 2023 Mar 9;15(1):215-226. doi: 10.3390/pediatric15010017.

Rehabilitation robots have shown promise in improving the gait of children with childhood-onset motor disabilities. This study aimed to investigate the long-term benefits of training using a wearable Hybrid Assistive Limb (HAL) in these patients. Training using a HAL was performed for 20 min a day, two to four times a week, over four weeks (12 sessions in total). The Gross Motor Function Measure (GMFM) was the primary outcome measure, and the secondary outcome measures were gait speed, step length, cadence, 6-min walking distance (6MD), Pediatric Evaluation of Disability Inventory, and Canadian Occupational Performance Measure (COPM). Patients underwent assessments before the intervention, immediately after the intervention, and at 1-, 2-, 3-month and 1-year follow-ups. Nine participants (five males, four females; mean age: 18.9 years) with cerebral palsy ($n = 7$), critical illness polyneuropathy ($n = 1$), and encephalitis ($n = 1$) were enrolled. After training using HAL, GMFM, gait speed, cadence, 6MD, and COPM significantly improved (all $p < 0.05$). Improvements in GMFM were maintained one year after the intervention ($p < 0.001$) and in self-selected gait speed and 6MD three months after the intervention ($p < 0.05$). Training using HAL may be safe and feasible for childhood-onset motor disabilities and may maintain long-term improvements in motor function and walking ability.

PMID: 36976724

20. Studies of CP Prevalence: Disparities in Authorship, Citations, and Geographic Location

Frances Avila-Soto, Angelina M Kakooza, Keisuke Ueda, Bhooma Aravamuthan

Review Pediatr Neurol. 2023 Feb 12;143:59-63. doi: 10.1016/j.pediatrneurol.2023.02.003. Online ahead of print.

We aimed to characterize the existing knowledge of cerebral palsy (CP) prevalence globally and identify any existing publication disparities that may impact our understanding of the global burden of CP. To identify existing publications on CP prevalence, PubMed and Web of Science were searched in May 2021 with the following strategy: "cerebral palsy"[title] AND (rate OR prevalence OR epidemiology). This search yielded 2720 results on PubMed and 2314 on Web of Science. Studies published in English, Spanish, or Japanese and which were available in full text were included. Studies that did not report a CP prevalence statistic were excluded. We identified 94 studies meeting inclusion and exclusion criteria. Of 94 studies, 69 (73.4%) studies came from Europe, North America, and Australia with the remaining 25 (26.6%) from Asia, the Middle East, and Africa. No studies from Latin America were identified. CP prevalence estimates ranged from 0.8 to 4.4 per 1000 live births. Studies from Europe are cited more than studies from other regions, ranging from 7.61 citations/year since publication for European studies to 2.1 citations/year for Middle Eastern studies. Studies from Western countries are written almost exclusively by Western authors (99.69%-100%), while studies from Africa consist of a lower proportion of African authors (31.06%). Our results highlight geographical disparities in our knowledge of CP epidemiology. Existing literature from Latin America, Asia, Africa, and the Middle East are relatively undercited by the field. To better grasp the true impact of CP globally, we must support institutions and researchers in underrepresented regions of the world.

PMID: 37001463

21. Incidence of Cerebral Palsy, Risk Factors, and Neuroimaging in Northeast Mexico

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Pediatr Neurol. 2023 Mar 3;143:50-58. doi: 10.1016/j.pediatrneurol.2023.02.005. Online ahead of print.

Background: Cerebral palsy (CP) comprises a group of lifelong motor and postural development disorders that can cause static motor encephalopathy. The etiology of CP is attributed to nonprogressive lesions of the central nervous system during fetal or infant brain development. A diagnosis of CP is based on a combination of clinical and neurological signs, typically identified between 12 and 24 months. A medical history, several available standardized tools, including the Neoneuro assessment, and the Hammersmith infant neurological examination (HINE) can be used to predict risk. Magnetic resonance imaging (MRI) can contribute to the diagnosis of CP. The incidence of CP is 2 to 3 per 1000 live births, and in Western industrialized nations, it is 2.0-2.5 per 1000 live births; to our knowledge, no epidemiological studies have reported the incidence of CP in Mexico. Aim: To assess the incidence of CP in children aged up to 18 months in northeast Mexico and analyze the risk factors and neuroimaging findings. Methods: This was a multicenter, randomized, prospective, cohort, analytical study of newborn children in three community hospitals and an early intervention and CP center in Nuevo Leon, Mexico, from 2017 to 2021. This study included 3861 newborns randomly selected from a population of 75,951 mothers in the immediate puerperium. According to the Neoneuro tool, high-risk children (n = 432) had abnormal neurological results at birth; they were followed and assessed with the Spanish version of the HINE test by a pediatric neurologist and underwent neuroimaging studies. Neonates with normal results were randomly selected to be in the low-risk group (n= 864). These neonates were followed and assessed with the HINE by a neonatologist. Results: The incidence of CP was 4.4 of 1000 up to 18 months old, which was higher than that reported in developed countries. Perinatal risk factors were predominantly recognized in the etiology of CP, such as brain hemorrhage, and prematurity, in addition to congenital anomalies. The most frequent neuroimaging findings were ventricular dilation/cortical atrophy and intraventricular/subependymal hemorrhage and periventricular leukomalacia on MRI. Conclusions: This study is the first on the incidence/prevalence of CP in Mexico, and there are no formal studies in this field in other Latin American countries either. The incidence of CP in northeast Mexico is higher than that reported in developed countries. The follow-up of high-risk young children must be reinforced in the Mexican population, as children with disabilities have high and sequential health-care needs and may usually be lost to follow-up. Neuroimaging of PVL was the more frequent finding by MRI in this population.

PMID: 37001462

22. Prevalence and risk factors for pediatric acute and chronic malnutrition: A multi-site tertiary medical center study in Thailand

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Asia Pac J Clin Nutr. 2023;32(1):85-92. doi: 10.6133/apjcn.202303_32(1).0013.

Background and objectives: Malnutrition is a major public health concern that increases morbidity and mortality in hospitalized patients, particularly those in developing countries. This study aimed to investigate its prevalence, risk factors, and impact on clinical outcomes in hospitalized children and adolescents. Methods and study design: We conducted a prospective cohort study in patients aged 1 month to 18 years who were admitted to four tertiary care hospitals between December 2018 and May 2019. We collected demographic data, clinical information, and nutritional assessment within 48 hours of admission. Results: A total of 816 patients with 883 admissions were included. Their median age was 5.3 years (interquartile range 9.3). Most patients (88.9%) were admitted with mild medical conditions (e.g., minor infection) or noninvasive procedures. The prevalence of overall malnutrition was 44.5%, while that of acute and chronic malnutrition was 14.3% and 23.6%, respectively. Malnutrition was significantly associated with age ≤2 years, preexisting diseases (cerebral palsy, chronic cardiac diseases, and bronchopulmonary dysplasia), and muscle wasting. Addi-tional risk factors for chronic malnutrition included biliary atresia, intestinal malabsorption, chronic kidney disease, as well as inability to eat and decreased food intake for >7 days. Malnourished patients had a significantly longer hospitalization duration, higher hospital cost, and nosocomial infection rates than did well-nourished patients. Conclusions: Patients with chronic medical conditions on admission are at risk for malnutrition. Therefore, determination of admission nutritional status must be assessed, and its management are requisites for improved inpatient outcomes.

PMID: 36997490

23. Children in Denmark with cerebral palsy rarely complete elementary school

Signe V Pedersen, Rikke Wiingreen, Bo M Hansen, Gorm Greisen, Mads L Larsen, Christina E Hoei-Hansen

Dev Med Child Neurol. 2023 Mar 27. doi: 10.1111/dmcn.15589. Online ahead of print.

Aim: To investigate how children with cerebral palsy (CP) perform in the Danish school system and which factors are associated with school performance. Method: This was a population-based cohort study including 463 126 children born from 1997 to 2003. Data were extracted from seven national registries. The study encompassed 818 children with CP (483 [59.0%] males, 335 [41.0%] females) and 417 731 without CP (214 535 [51.4%] males, 203 196 [48.6%] females). We evaluated two primary outcomes: not completing 10 years of elementary school, defined as attending fewer than eight final mandatory exams; and grade point averages (GPAs). Mann-Whitney U tests were used to analyse differences in GPAs and logistic regressions were used to calculate odds ratios (ORs). Results: Among children with and without CP, 62.6% and 12.4% did not complete elementary school respectively (OR = 11.85 [10.28-13.66]). Additionally, children with CP who attended all final exams achieved lower overall GPAs than children without CP (6.6 vs 7.3, p = 0.001). In children with CP, comorbidities, maternal education, severity of motor impairments, and intellectual deficits were associated with increased odds of not completing elementary school. Notably, one-third of children with CP with apparent normal intelligence did not complete school, despite special educational measures. Interpretation: Danish children with CP rarely complete elementary school despite initiatives for a more supportive educational system. The complexity of individual needs in children with CP may be challenging for an inclusive school environment.

PMID: 36974362

24. Preventive practices and parents' psychological health of children with disabilities after COVID-19 lockdown in Pakistan

Anam Ali, Muhammad Nauman, Shazia Maqbool

J Paediatr Child Health. 2023 Mar 31. doi: 10.1111/jpc.16397. Online ahead of print.

Aim: To find out differences in mental health outcomes between parents of children with different disabilities due to COVID-19 by determining the relationship between preventive practices, fear and stress in parents of disabled children. Methods: A sample of 213 parents, whose children with disabilities (age range 1-16 years) were previously on regular follow-up before pandemic but did not take therapy for 1 year or more during COVID-19 lockdown and resumed sessions after a gap period, was surveyed. Perceived stress scale, fear and adherence to preventive measures questionnaire (developed by researchers) were used to measure stress, fear response of parents due to COVID-19 and preventive measures practiced by disabled children respectively. Results: Parents who had financial difficulties and believed their disabled children had more chance of getting COVID-19 were more stressed. Parents who received any help from community/government were less stressed. One-way analysis of variance showed parents of cerebral palsy (CP) children reported more stress of COVID-19 as compared to parents of autism spectrum disorder (ASD), global developmental delay (GDD) and intellectual disability (ID). Parents of ID children reported more stress than ASD. Parents of CP children had more fear of loss of family members or getting infected with COVID-19 than GDD parents. ASD, GDD and CP children adhered more to preventive measures than ID children; however, CP children adhered more to preventive measures than GDD children. Conclusion: COVID-19 lockdown has persisting impact on mental health of parents of disabled children. Those parents experienced increased levels of stress and fear but reported adherence to preventive measures depending on the child's disability.

PMID: 36999958

25. Norwegian paediatric habilitation centres judge their own competence on cerebral visual impairment as limited

Pamela Friede, Sandra Julsen Hollung, Torstein Vik, Guro Lillemoen Andersen, David Lansing Cameron, Sigrid Aune de Rodez, Olav H Haugen, Tonje Lundervold, Jude Nicholas, Kristine Stadskleiv

Acta Paediatr. 2023 Mar 30. doi: 10.1111/apa.16778. Online ahead of print.

Aim: Cerebral visual impairment (CVI), a frequently occurring functional impairment in children with neurodevelopmental disorders, leads to communicative, social and academic challenges. In Norway, children with neurodevelopmental disorders are

assessed at paediatric habilitation centres. Our aims were to explore how CVI is identified, how paediatric habilitation centres assess their CVI competence, and the reported prevalence of CVI among children with cerebral palsy. Methods: An electronic questionnaire was sent to all 19 Norwegian paediatric habilitation centre leaders in January 2022. The results were analysed quantitatively and qualitatively. The prevalence of CVI among children with cerebral palsy was estimated using register-based data. Results: The questionnaire was answered by 17. Only three judged their habilitation centre as having sufficient competence on CVI. None of the centres used screening questionnaires systematically, and 11 reported that CVI assessment was not good enough. Awareness that a child may have CVI typically occurred during examinations for other diagnoses. The prevalence of CVI among children with cerebral palsy was only 8%, while CVI status was unknown in 33%. Conclusion: Better knowledge and assessment of CVI at Norwegian paediatric habilitation centres is needed. CVI appears to be often overlooked in children with neurodevelopmental disorders.

PMID: 36997302

26. Quality appraisal of systematic reviews of interventions for children with cerebral palsy reveals critically low confidence

No authors listed

Dev Med Child Neurol. 2023 Mar 30. doi: 10.1111/dmcn.15603. Online ahead of print.

No abstract available

PMID: 36996289

27. Prevalence of depression, anxiety, and substance-related disorders in parents of children with cerebral palsy: A systematic review

No authors listed

Dev Med Child Neurol. 2023 Mar 30. doi: 10.1111/dmcn.15600. Online ahead of print.

No abstract available

PMID: 36996287

28. Prevalence and incidence of chronic conditions among adults with cerebral palsy: A systematic review and meta-analysis

No authors listed

Dev Med Child Neurol. 2023 Mar 30. doi: 10.1111/dmcn.15601. Online ahead of print.

No abstract available

PMID: 36996285

29. Evaluation of Sleep in Children with Cerebral Palsy: A Must do Component for Holistic Management

Deepthi Krishna, Biswaroop Chakrabarty

Editorial Indian J Pediatr. 2023 Mar 30. doi: 10.1007/s12098-023-04525-9. Online ahead of print.

No abstract available

PMID: 36995645

30. Correction to: Interventions with an Impact on Cognitive Functions in Cerebral Palsy: A Systematic Review

Montse Blasco, María García-Galant, Alba Berenguer-González, Xavier Caldú, Miquel Arqué, Olga Laporta-Hoyos, Júlia Ballester-Plané, Júlia Miralbell, María Ángeles Jurado, Roser Pueyo

Published Erratum Neuropsychol Rev. 2023 Mar 30. doi: 10.1007/s11065-023-09590-7. Online ahead of print.

No abstract available

PMID: 36995638

31. Scalp acupuncture Yikang therapy on Baihui (GV20), Sishencong (EX-HN1), Zhisanzhen, Niesanzhen improves neurobehavior in young rats with cerebral palsy through Notch signaling pathway

Xue Jianyi, X U Jinyan, Huang Mao, Y U Wentao, Yan Yihui, Yan Yuanjie, Yin Zhenjin, L U Qian, Peng Wanying, Yan Siyang

J Tradit Chin Med. 2023 Apr;43(2):337-342. doi: 10.19852/j.cnki.jtcm.20221206.002.

Objective: To investigate the efficacy of scalp acupuncture Yikang therapy on Baihui (GV20), Sishencong (EX-HN1), Zhisanzhen, Niesanzhen, on neurobehavior in young rats with cerebral palsy based on Notch signaling pathway. Methods: Thirty 7-day-old rats were randomly divided into sham, model and acupuncture, 10 rats in each group. The cerebral palsy model was established by the accepted modeling method, the acupuncture group selected "Baihui (GV20)", "Sishencong (EX-HN1)", "Zhisanzhen" and "Niesanzhen" for intervention 24 h after the model was made. The body masses were recorded before and after the treatment, respectively. After the intervention, the rats were subjected to suspension experiment, slope experiment, tactile stimulation experiment and Morris water maze experiment. After the end of the experiment, the morphological changes of hippocampal histology were observed by hematoxylin-eosin (HE) staining under light microscope, and the expression of Notch1, Notch3 and Hes5 were detected by Western blot and quantitative real-time polymerase chain reaction (PCR). Results: The changes in body mass of the rats in each group were different; in behavioral experiments, compared with the sham, the suspension time of the model was shortened, the slope experiment, tactile stimulation experiment, and escape latency time were prolonged, and the number of platform crossing was reduced in the model, compared with the model, the suspension time of the acupuncture was prolonged, the slope experiment, tactile stimulation experiment, and escape latency time were shortened, and the number of platform crossing times was increased; HE staining showed severe hippocampal damage in the model and reduced hippocampal damage in the acupuncture. Western Blot and real-time fluorescence quantitative PCR showed that the expression of Notch1, Notch3 and Hes5 were increased in the model and the expression of Notch1, Notch3, Hes5 in acupuncture were decreased. Conclusions: Scalp acupuncture Yikang therapy may improve neurobehavior and reduce brain injury in rats with cerebral palsy by downregulating the expression of Notch1, Notch3, and Hes5.

PMID: 36994522

32. Seizure Burden and Neurologic Outcomes After Neonatal Encephalopathy

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Neurology. 2023 Mar 29;10.1212/WNL.0000000000207202. doi: 10.1212/WNL.0000000000207202. Online ahead of print.

Background and objectives: Seizures are common during neonatal encephalopathy, but the contribution of seizure burden to outcomes remains controversial. This study aims to examine the relationship between electrographic seizure burden and neurological outcomes after neonatal encephalopathy. Methods: This prospective cohort study recruited newborns ≥36 weeks PMA around 6 hours of life between August 2014 to November 2019 from a Neonatal Intensive Care Unit. Participants underwent continuous electroencephalography for at least 48 hours, brain MRI within 3-5 days of life, and structured follow-up at 18 months. Electrographic seizures were identified by board-certified neurophysiologists, and quantified as total seizure burden and maximum hourly seizure burden. A medication exposure score was calculated based on all anti-seizure medications given during NICU admission. Brain MRI injury severity was classified based on basal ganglia and watershed scores. Developmental outcomes were measured using the Bayley Scales of Infant Development, 3rd Edition. Multivariable regression

analyses were performed, adjusting for significant potential confounders. Results: Of 108 enrolled subjects, 98 subjects had cEEG and MRI data collected, of which 5 were lost to follow-up, and 6 died before age 18 months. All subjects with moderate-severe encephalopathy completed therapeutic hypothermia. cEEG-confirmed neonatal seizures occurred in 21(24%) newborns, with a total seizure burden mean of 12.5 ± 36.4 minutes, and a maximum hourly seizure burden mean of 4 ± 10 min/hr. After adjusting for MRI brain injury severity and medication exposure, total seizure burden was significantly associated with lower cognitive (-0.21, 95%CI -0.33 - -0.08, p=0.002) and language (-0.25, 95%CI -0.39 - -0.11, p=0.001) scores at 18 months. Total seizure burden of 60 minutes was associated with 15-point decline in language scores, and 70 minutes for cognitive scores. However, seizure burden was not significantly associated with epilepsy, neuromotor score, or cerebral palsy (p>0.1). Discussion: Higher seizure burden during neonatal encephalopathy was independently associated with worse cognitive and language scores at 18 months, even after adjusting for exposure to anti-seizure medications and severity of brain injury. These observations support the hypothesis that neonatal seizures occurring during neonatal encephalopathy independently contribute to long-term outcomes.

PMID: 36990719

33. Dendrimer conjugated glutamate carboxypeptidase II inhibitor restores microglial changes in a rabbit model of cerebral palsy

Nirnath Sah, Zhi Zhang, Alicia Chime, Amanda Fowler, Antonio Mendez-Trendler, Anjali Sharma, Kannan Rangaramanujam, Barbara Slusher, Sujatha Kannan

Dev Neurosci. 2023 Mar 29. doi: 10.1159/000530389. Online ahead of print.

We have previously shown that maternal endotoxin exposure leads to a phenotype of cerebral palsy and pro-inflammatory microglia in the brain in neonatal rabbits. 'Activated' microglia overexpress the enzyme glutamate carboxypeptidase II (GCPII) that hydrolyzes N-acetylaspartylglutamate (NAAG) to N-acetylaspartate (NAA) and glutamate, and we have shown previously that inhibiting microglial GCPII is neuroprotective. Glutamate-induced injury and associated immune signaling can alter microglial responses including microglial process movements for surveillance and phagocytosis. We hypothesize that inhibition of GCPII activity could alter microglial phenotype and normalize microglial processes movement/dynamics. Newborn rabbit kits exposed to endotoxin in utero, when treated with dendrimer conjugated 2-PMPA (D-2PMPA), a potent and selective inhibitor of microglial GCPII, showed profound changes in microglial phenotype within 48-hour of treatment. Live imaging of hippocampal microglia in ex-vivo brain slice preparations revealed larger cell body and phagocytic cup sizes with less stable microglia processes in CP kits compared to healthy controls. D-2PMPA treatment led to significant reversal of microglial process stability to healthy control levels. Our results emphasize the importance of microglial process dynamics in determining the state of microglial function in the developing brain and demonstrate how GCPII inhibition specifically in microglia can effectively change the microglial process motility to healthy control levels potentially impacting migration, phagocytosis, and inflammatory functions.

PMID: 36990069

34. MECP2 duplication syndrome initially misdiagnosed as cerebral palsy: a case report

Tae-Yong Ki, Su-Ji Lee, Kyung-Min Kim, Sung-Rae Cho

Case Reports J Int Med Res. 2023 Mar;51(3):3000605231162452. doi: 10.1177/03000605231162452.

Mutations in the X-linked methyl-CpG-binding protein 2 (MECP2) gene were first described as a cause of Rett syndrome. MECP2 duplication can cause intellectual disability, developmental delay, severe feeding difficulties, and recurrent infections. Here, we report a Korean family with MECP2 duplication syndrome, which was previously misdiagnosed as cerebral palsy. A man in his early 30 s visited our clinic with intellectual disability, speech impairment, epilepsy, and progressive spasticity. He had been previously misdiagnosed with cerebral palsy, and had received orthopedic surgeries such as musculotendinous lengthening and derotational osteotomy. After the surgeries, he received comprehensive rehabilitation. Upon carefully checking his family history, we noted that his younger brother had similar symptoms. Next-generation sequencing revealed whole exon duplication in MECP2 in both the patient and his brother; their mother also had this genetic mutation but was asymptomatic. Early diagnosis is essential for improving the success of MECP2 duplication syndrome treatment. Individuals with MECP2 duplication syndrome should be referred to specialists to manage multidisciplinary symptoms and to regularly check for complications that are common in this syndrome.

PMID: 36988314

35. Predicting Gross Motor Function in Children and Adolescents with Cerebral Palsy Applying Artificial Intelligence Using Data on Assistive Devices

Lisa von Elling-Tammen, Christina Stark, Kim Ramona Wloka, Evelyn Alberg, Eckhard Schoenau, Ibrahim Duran

J Clin Med. 2023 Mar 13;12(6):2228. doi: 10.3390/jcm12062228.

Data obtained from routine clinical care find increasing use in a scientific context. Many routine databases, e.g., from health insurance providers, include records of medical devices and therapies, but not on motor function, such as the frequently used Gross Motor Function Measure-66 (GMFM-66) score for children and adolescents with cerebral palsy (CP). However, motor function is the most common outcome of therapeutic efforts. In order to increase the usability of available records, the aim of this study was to predict the GMFM-66 score from the medical devices used by a patient with CP. For this purpose, we developed the Medical Device Score Calculator (MDSC) based on the analysis of a population of 1581 children and adolescents with CP. Several machine learning algorithms were compared for predicting the GMFM-66 score. The random forest algorithm proved to be the most accurate with a concordance correlation coefficient (Lin) of 0.75 (0.71; 0.78) with a mean absolute error of 7.74 (7.15; 8.33) and a root mean square error of 10.1 (9.51; 10.8). Our findings suggest that the MDSC is appropriate for estimating the GMFM-66 score in sufficiently large patient groups for scientific purposes, such as comparison or efficacy of different therapies. The MDSC is not suitable for the individual assessment of a child or adolescent with CP.

PMID: 36983229

36. Different Protocols for Low Whole-Body Vibration Frequency for Spasticity and Physical Performance in Children with Spastic Cerebral Palsy

Punnee Peungsuwan, Uraiwan Chatchawan, Wanida Donpunha, Pisamai Malila, Thanyaluck Sriboonreung

Children (Basel). 2023 Feb 26;10(3):458. doi: 10.3390/children10030458.

Background: Whole-body vibration (WBV) is a therapeutic exercise tool that can be used in children with cerebral palsy (CP). A low vibration frequency with different protocols has been suggested, but no optimal dose has been explicitly indicated. We aimed to determine the superiority of a gradually increased 7-18 Hz WBV protocol over a static 11 Hz WBV and the immediate and short-term effects of WBV training on improving spasticity, functional strength, balance, and walking ability in children with spastic CP. Methods: Twenty-four participants with CP (mean age: 11.5 ± 2.9 years) were randomly allocated into protocols of a static 11 Hz vibration frequency group (SVF) or one that increased from a 7 to an 18 Hz vibration frequency (IVF) (n = 12/group). The WBV programmes were completed for 30 min/session/day to identify immediate effects, and the short-term programme then continued for four days/week for eight weeks. Results: Modified Ashworth Scale scores significantly and immediately improved in the IVF group (hip adductor and knee extensor, $p < 0.05$), and after eight weeks showed significant improvement in the SVF group (ankle plantar flexor, $p < 0.05$). Within groups, the Five Times Sit to Stand Test (FTSTS), the Time Up and Go Test and the Functional Reach Test significantly improved in the SVF group, whereas only the FTSTS improved in the IVF group ($p < 0.05$). There were no significant between-group differences at the eight-week postintervention, except reduced spasticity. Conclusions: A protocol of 7-18 Hz WBV seems to offer superior immediate results in terms of improved spasticity; however, a static 11 Hz protocol appears to offer superior results after eight weeks, although the two protocols did not differ significantly in effects on physical performance. This finding may facilitate preparations to normalise muscle tone before functional mobility therapy. The study results may support future studies about the dose-response of WBV frequency.

PMID: 36980015

37. Title: Caring for Children with Cerebral Palsy: A Challenge to Caregivers in Rural Areas of South Africa

Duppy Manyuma, Mary Maluleke, Ndidzulafhi Selina Raliphaswa, Thingahangwi Cecilia Masutha, Mphedziseni Esther Rangwaneni, Takalani Eldah Thabathi, Ndivhaleni Robert Lavhelani

Children (Basel). 2023 Feb 24;10(3):440. doi: 10.3390/children10030440.

Background: In South Africa, children with cerebral palsy are nested within a family setting by immediate relatives,

particularly in the rural areas. These immediate relatives are regarded as caregivers and are not trained with regard to providing care to children with special needs. Therefore, they have to find ways to adapt to their new roles of caregiving using the available resources. The aim of this paper is to present the challenges encountered by caregivers of children with cerebral palsy in rural areas of South Africa. Methods: This qualitative, explorative, descriptive, and contextual study included 10 caregivers for children with cerebral palsy who were purposively recruited from the three respective hospitals in Vhembe District within Limpopo Province. Data were collected through individual in-depth interviews and analysed using a thematic approach. Ethical considerations and measures to ensure trustworthiness were upheld throughout the study. Results: Four themes emerged from the study, namely economic problems facing caregivers; health problems encountered by caregivers; maltreatment of caregivers by community members, as well as access to transport for caregivers and children. Conclusion: Participants narrated that caring for a child with cerebral palsy is not an easy task for the caregiver, particularly in the rural areas of South Africa. They encounter various challenges as they strive to provide quality care to the children that they are caring for. An investigation is recommended concerning the kind of model which should be developed to support caregivers in caring for children with cerebral palsy in the rural areas.

PMID: 36979998

38. Effects of Telerehabilitation-Based Structured Home Program on Activity, Participation and Goal Achievement in Preschool Children with Cerebral Palsy: A Triple-Blinded Randomized Controlled Trial

Sinem Asena Sel, Mintaze Kerem Günel, Sabri Erdem, Merve Tunçdemir

Children (Basel). 2023 Feb 22;10(3):424. doi: 10.3390/children10030424.

A home program is implemented as an evidence-based mode of delivering services for physiotherapy and rehabilitation. Telerehabilitation is a method applied in physiotherapy modalities for children. This study aims to determine the effectiveness of usual care plus a Telerehabilitation-Based Structured Home Program on preschool children with cerebral palsy (CP) compared to usual care. Forty-three children aged 3-6 years (mean age 4.66 ± 1.08 years) with CP were randomly assigned to the Telerehabilitation-Based Structured Home Program and usual care groups. Their motor function was assessed with the Gross Motor Function Measure (GMFM); performance and satisfaction were evaluated with the Canadian Occupational Performance Measure (COPM); goal achievement was assessed with the Goal Attainment Scale (GAS); and activity and participation were evaluated with Pediatric Evaluation of Disability Inventory (PEDI). Participants were evaluated at baseline, immediately post-intervention (12 weeks) and at follow-up (24 weeks). There was a statistically significant difference between pre- and post-test GMFM, COPM, GAS and PEDI scores in the intervention and control groups ($p < 0.001$). The Telerehabilitation-Based Structured Home Program showed statistically significant changes in activity, participation and goal achievement after 12 weeks of intervention ($p < 0.001$). However, significant results were not obtained in the usual care group. The Telerehabilitation-Based Structured Home Program may be an effective method for preschool children with CP. (Registration number: NCT04807790; no = KA-20124/26.01.2021).

PMID: 36979982

39. Goal attainment of children with cerebral palsy participating in multi-modal intervention

Kathryn Bain, Suzanne Davis Bombria, Christine Janet Chapparo, Michelle Donelly, Robert Heard, Sue Treacy

Child Care Health Dev. 2023 Mar 28. doi: 10.1111/cch.13117. Online ahead of print.

Aim: We aimed to determine if there was a significant difference in the functional performance of family requested daily tasks by a heterogeneous group of children with cerebral palsy following a programme of neuro-developmental treatment and in comparison to a randomly control group. Background: There are considerable challenges in conducting research into the functional performance of children with cerebral palsy. These include the highly heterogeneous nature of the population group, poor ecological and treatment fidelity, floor and ceiling effects in assessments, and insensitivity to the diverse functional needs and goals of children and families. Therapists and families identified functional goals and specified all aspects of performance details for each goal on five point goal attainment scales. Children with cerebral palsy were assigned randomly to treatment and alternate treatment groups. Children were video recorded attempting to perform targeted functional skills at pre-test, post-pest and follow-up. Videos were recorded and rated by expert clinicians blind to experimental condition. Results: After the first round of target intervention and alternate treatment had been completed, a significant difference in the goal attainment was noted between the control group and the treatment group at the post test, indicating that intervention was associated with a higher level of goal attainment than that attained by the control group ($p = 0.0321$) with a large effect size. Conclusions: The study provided evidence of an effective way to investigate and to enhance the available motor capacity of children with moderate to severe cerebral palsy during participation in requested daily task performance, as reflected in goal attainment. Goal attainment scales were a reliable measure that was able to be used to detect changes in functional goals among a highly

heterogeneous population group with individualized goals that were meaningful to each child and family.

PMID: 36977609

40. Perinatal antecedents of moderate and severe neonatal hypoxic ischaemic encephalopathy: An Australian birth cohort study

Rosie Stoke, Veronika Schreiber, Kaycee Hocking, Luke Jardine, Sailesh Kumar

Aust N Z J Obstet Gynaecol. 2023 Mar 27. doi: 10.1111/ajo.13665. Online ahead of print.

Background: Neonatal hypoxic ischaemic encephalopathy (HIE) is the most common cause of encephalopathy in the neonatal period and carries a high risk of mortality and long-term morbidity. Aim: The aim of this study was to investigate key antecedents of moderate and severe HIE in a large contemporary birth cohort. Methods: A retrospective cohort study of births meeting criteria was conducted between 2016 and 2020 at the Mater Mothers' Hospital, Brisbane, Australia. This is a quaternary perinatal centre and Australia's largest maternity hospital. Univariate and multivariate Firth logistic regression were used to account for imbalanced frequency classes between non-HIE and HIE groups. Maternal variables and intrapartum factors were investigated for associations with neonatal moderate and severe HIE. Results: Overall, 133 of 46 041 (0.29%) infants were diagnosed with HIE: 77 (0.17%) with mild HIE and 56 (0.12%) with moderate/severe HIE. Nulliparity, type 1 diabetes mellitus and maternal intensive care unit admission were associated with increased odds of moderate/severe HIE. Intrapartum risk factors included emergency caesarean birth, emergency caesarean for non-reassuring fetal status or failure to process, intrapartum haemorrhage and an intrapartum sentinel event (shoulder dystocia, cord prolapse, uterine rupture and placental abruption). Neonatal risk factors included male sex, late preterm gestation (35+0 -36+6 weeks), Apgar score less than four at 5 min, severe respiratory distress requiring ventilatory support and severe acidosis at birth. Conclusions: This cohort study identified a series of potentially modifiable maternal and obstetric risk factors for HIE. Risk factors for HIE do not appear to have changed significantly with evolution in modern obstetric care.

PMID: 36974351

41. The epidemiological characteristics of neurogenic limb deformity disorder in China: a national-based study from Qin Sihe orthopedic center

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Background: Neurogenic limb deformity disorder (NLDD) refers to limb deformity disorders caused by various neurogenic disorders. However, there are no studies to systematically summarize and analyze these diseases in China, and we first proposed the concept of NLDD. We describe the epidemiological characteristics of NLDD in China based on the largest case database of limb orthopedics in China. Methods: This study analyzed parameters from the Qin Sihe Orthopedic Surgery Case Data (QSHOSCD). The database is based on the Rehabilitation Hospital affiliated to National Research Center for Rehabilitation, which has collected nearly 37,000 patients to date and includes a wide variety of limb deformities. The types of diseases are summarized and classified for all patients studied. Statistical analysis was based on the type of etiology, age, regional distribution, and historical surgical volume. Partial outcomes were statistically analyzed separately by common diseases (polio and cerebral palsy) and rare diseases (37 other diseases). Results: From 1979 to 2019, 30,194 patients with NLDD were treated surgically for 39 neurogenic disorders. The male to female ratio was 1.48:1, the mean age was 19.65 years, and most patients (82.38%) were aged between 6 and 30 years. Patients included from 32 provinces and cities across China, mainly concentrated in populous central provinces and Heilongjiang Province. The peak of annual surgical procedures was from 1988 to 1994, and the number of annual surgical procedures for common diseases gradually decreased from 1994 onwards, but the trending is opposite for rare diseases. Conclusions: This study is the first to demonstrate the disease types, population characteristics and incidence trends of NLDD in China. It suggests that the prevention and treatment of NLDD should focus on the adolescent population and enhance the treatment of neurogenic diseases that cause limb deformities. The growth and adaption of the Ilizarov technique and its practice in Chinese orthopedic benefits the treatment of neurogenic limb deformity disorders.

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42. Safety and Effectiveness of Ethanol Neurolysis With and Without OnabotulinumtoxinA in Children with Cerebral Palsy

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Introduction: OnabotulinumtoxinA is commonly used to relieve spasticity in children with neurologic disorders. Ethanol neurolysis may be used to target more muscles, but is less well studied, especially in pediatrics. Objective: This prospective quality improvement study aimed to determine the safety and effectiveness of ethanol neurolysis with onabotulinumtoxinA injections compared to only onabotulinumtoxinA injections for the treatment of spasticity in children with cerebral palsy. Design: Cohort study including patients with cerebral palsy receiving onabotulinumtoxinA and/or ethanol neurolysis from June 2020 to June 2021. Setting: Outpatient physiatry clinic. Patients: A total of 167 children with cerebral palsy not undergoing other treatments during injection period. Interventions: Injection with either onabotulinumtoxinA only (112 children) or a combination of ethanol and onabotulinumtoxinA injections (55 children) using both ultrasound guidance and electrical stimulation. Main outcome measures: A post-procedure evaluation at 2 weeks post-injection documented any adverse effects experienced by the child and perceived magnitude of improvement using an ordinal scale from 1-5. Multiple linear regression was used to identify and control for covariates including Gross Motor Function Classification System (GMFCS), sex, age, weight, ethnicity, race, and dosage RESULTS: Only weight was identified as a confounding factor. When controlled for weight, combined BTX-A and ethanol injections of onabotulinumtoxinA and alcohol had a greater magnitude of improvement (3.78/5) compared to onabotulinumtoxinA injections alone (3.44/5), a difference of 0.34 points on the rating scale (0.01-0.69 95% CI; p=0.045). However, the difference was not clinically significant. Looking at adverse effects, one patient in the onabotulinumtoxinA-only group and two patients in the combined BTX-A and ethanol group reported mild, self-limiting adverse effects. Conclusion: Ethanol neurolysis under ultrasound and electrical stimulation guidance may be a safe and effective treatment for children with cerebral palsy that allows more spastic muscles to be treated than onabotulinumtoxinA alone.

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43. Predictors of whole exome sequencing in dystonic cerebral palsy and cerebral palsy-like disorders

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Introduction: Cerebral palsy (CP) is a group of permanent disorders attributed to non-progressive disturbances that occurred in the developing fetal or infant brain. Cerebral palsy-like (CP-like) disorders may clinically resemble CP but do not fulfill CP criteria and have often a progressive course and/or neurodevelopmental regression. To assess which patients with dystonic CP and dystonic CP-like disorder should undergo Whole Exome Sequencing (WES), we compared the rate of likely causative variants in individuals regarding their clinical picture, co-morbidities, and environmental risk factors. Method: Individuals with early onset neurodevelopmental disorder (ND) manifesting with dystonia as a core feature were divided into CP or CP-like cohorts based on their clinical picture and disease course. Detailed clinical picture, co-morbidities, and environmental risk factors including prematurity, asphyxia, SIRS, IRDS, and cerebral bleeding were evaluated. Results: A total of 122 patients were included and divided into the CP group with 70 subjects (30 males; mean age 18y5m±16y6m, mean GMFCS score 3.3 ± 1.4), and the CP-like group with 52 subjects (29 males; mean age 17y7m±1y,6 m, mean GMFCS score 2,6 ± 1,5). The WES-based diagnosis was present in 19 (27.1%) CP patients and 30 CP-like patients (57.7%) with genetic conditions overlap in both groups. We found significant differences in diagnostic rate in CP individuals with vs. without risk factors (13.9% vs. 43.3%); Fisher's exact p = 0.0065. We did not observe the same tendency in CP-like (45.5% vs 58.5%); Fisher's exact p = 0.5. Conclusion: WES is a useful diagnostic method for patients with dystonic ND, regardless of their presentation as a CP or CP-like phenotype.

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44. Barriers in translating stem cell therapies for neonatal diseases

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Over the last 20 years, stem cells of varying origin and their associated secretome have been investigated as a therapeutic option for a myriad of neonatal models of disease, with very promising results. Despite the devastating nature of some of these disorders, translation of the preclinical evidence to the bedside has been slow. In this review, we explore the existing clinical evidence for stem cell therapies in neonates, highlight the barriers faced by researchers and suggest potential solutions to move