Cerebral Palsy ALLIANCE

Cerebral palsy research news

Monday 20 September 2021

Cerebral Palsy Alliance is delighted to bring you this free weekly bulletin of the latest published research into cerebral palsy. Our organisation is committed to supporting cerebral palsy research worldwide - through information, education, collaboration and funding. Find out more at cerebralpalsy.org.au/our-research

Professor Nadia Badawi AM
CP Alliance Chair of Cerebral Palsy Research

Subscribe to CP Research News

Interventions and Management

1. Efficacy of different approaches on quality of upper extremity function, dexterity and grip strength in hemiplegic children: a randomized controlled study
R A Mohamed, A M Yousef, N L Radwan, M M Ibrahim

Eur Rev Med Pharmacol Sci. 2021 Sep;25(17):5412-5423. doi: 10.26355/eurrev_202109_26648.

Objective: To investigate the effect of mirror therapy (MT) together with taping compared to modified constraint-induced movement therapy (mCIMT) and MT alone on the quality of upper extremity (UE) function, dexterity, and grip strength in children with hemiplegic cerebral palsy (CP). Patients and methods: Sixty children with hemiplegic CP ranging in age from 6 to 8 years were enrolled. The participants were randomly distributed into three groups. The three groups underwent the same suggested upper limb (UL) exercise programme for 1h/5 days/week for 12 successive weeks. Group A performed the programme with MT and taping. Group B performed the same programme using mCIMT alone, while group C performed this programme with MT alone. In addition, the three groups underwent a routine physical therapy programme for 1 h. The quality of UE function, dexterity, and grip strength was measured using the Quality of Upper Extremity Skills Test (QUEST), Box and Block Test (BBT), and hand-held dynamometer before and after 12 successive weeks of treatment. Results: After treatment, the measurement of all variables in the three groups showed significant improvements with superior effects seen in group A. Conclusions: Based on the results obtained in this study, MT with taping, mCIMT alone, and MT alone are good supplements to traditional physical therapy programmes in improving the quality of UE function, dexterity, and grip strength in children with hemiplegic CP with more superior effects seen after using MT together with taping.

PMID: 34533816

2. Complication rate after scoliosis surgery in children with cerebral palsy
Elke Vandendriessche, Marijke Proesmans, Els Ortibus, Pierre Moens

Acta Orthop Belg. 2021 Jun;87(2):255-261.

Scoliosis is an important problem in children with cerebral palsy (CP). However, the choice for a spinal fusion has to be weighed against the risks of major surgery in this vulnerable population. Paediatricians are frequently consulted preoperatively to assess the (respiratory) risk involved, but data on this question specific for CP are rare. Therefore, we investigated the complication rate after scoliosis surgery in children with CP, compared to idiopathic scoliosis (IS), and we searched for risk factors for the most common complications. In a retrospective monocenter study we analyzed the medical records from all children with CP and IS undergoing scoliosis surgery from 2010 until 2014. Duration of hospitalization and postoperative complications were compared within a 6-month follow-up. Univariate and multivariate logistic regression models were used to identify risk factors. The study included 44 patients with CP (mean age 15y0mo) and 78 patients with IS (mean age 14y6mo). Children with CP experience a higher rate of complications : respiratory and cardiovascular, as well as

wound infections and decubitus ulcers (p<0.05). Postoperative pneumonia was the most frequent complication in both patient groups (43% and 18% in CP and IS respectively), with epilepsy being a significant risk factor (OR 3.85, p= 0.037) in children with CP. Intensive care unit and total hospital stay were longer in the CP group (p<0.001). These results may add information on perioperative care and surgical decision making.

PMID: 34529378

3. Radiographic hip screening for children with cerebral palsy: an imaging and reporting update
Kathryn S Milks, Amanda T Whitaker, Lynne Ruess

Pediatr Radiol. 2021 Sep 13. doi: 10.1007/s00247-021-05197-3. Online ahead of print.

Children with cerebral palsy are at increased risk of hip dislocation. Detecting hip subluxation through radiographic hip screening is an essential component of hip surveillance and has been shown to prevent hip dislocations. Large-scale hip surveillance programs are being implemented nationwide, highlighting the importance of uniform technical and reporting standards.

PMID: 34518936

4. Validation of the Gait Outcomes Assessment List questionnaire and caregiver priorities for individuals with cerebral palsy
Elizabeth R Boyer, Madeline Palmer, Kathryn Walt, Andrew G Georgiadis, Jean L Stout

Dev Med Child Neurol. 2021 Sep 17. doi: 10.1111/dmcn.15054. Online ahead of print.

Aim: To expand upon previous validation of the Gait Outcomes Assessment List (GOAL) questionnaire in individuals with cerebral palsy (CP), to rank items by importance, and to summarize written-in (free text) goals. Method: For this cross-sectional study, the parent-version 5.0 of the GOAL was completed by 310 consecutive caregivers of 310 individuals aged 3 to 25 years with CP (189 males, 121 females; mean [SD] age: 10y [4y 2mo]; Gross Motor Function Classification System [GMFCS] levels I-IV) concurrent with a gait analysis. Distribution properties and validity were quantified using questionnaires, kinematics, and oxygen consumption. Items classified as at least 'difficult' to perform and 'very important' to improve were considered caregiver priorities and rank ordered. Free text goals were categorized. Results were summarized for everyone and by GMFCS level. Results: Most scores were normally distributed. Validity was acceptable, with concurrent greater than construct validity. Among all 310 caregivers, fatigue was the highest priority, followed by gait pattern and appearance items. The rank of priorities varied by GMFCS level. Common free text goals included toileting independently as well as improved fine motor and ball sport skills. Interpretation: The GOAL is a valid tool that can help prioritize goals across GMFCS levels I to IV. Identifying the top goals may improve shared decision-making and prioritize research for this sample.

PMID: 34534360

5. Oral Health, Dental Care and Nutritional Habits of Children with Cerebral Palsy during Conductive Education
M Orsós, D Antal, D S Veres, K Nagy, O Németh

J Clin Pediatr Dent. 2021 Oct 1;45(4):239-246. doi: 10.17796/1053-4625-45.4.4.

Objective: Regarding the 2011 census in Hungary, the number of children with movement deficiences can be around 7,000. These children with special health care needs are considered to be a vulnerable group even from a dental point of view. In our dental program, we gain comprehensive information about patients' oral health, health behavior, and monitor dental care. Study design: A total of 199 children went through a full pediatric dental examination, children with cerebral palsy were categorized into five different levels (GMFCS) and children without motor disfunction into two groups. We analyzed the df-t and DMF-T values. Oral hygiene routine, dental care, gingivitis, demographic characteristics, nutritional habits odds ratio to df-t and DMF-T were surveyed. Results: The mean df-t and DMF-T was 1.87 and 1.15 out of a total of 199, and the group that scored worse

was the GMFCS II. The mean RI (restorative index) was 18.12% and 27% for decidous and permanent teeth, respectively. The prevalence of gingivitis was 66.7%. Conclusion: The results of our research point to the fact that children with cerebral palsy have difficulties in developing and maintaining proper oral health due to their disadvantages and therefore require special care and attention.

PMID: 34534305

6. Pain phenotypes among adults living with cerebral palsy and spina bifida
Mark D Peterson, Heidi Haapala, Neil Kamdar, Paul Lin, Edward A Hurvitz

Pain. 2021 Oct 1;162(10):2532-2538. doi: 10.1097/j.pain.0000000000002240.

Chronic pain is the most commonly reported physical symptomology of cerebral palsy (CP) and spina bifida (SB) throughout the lifespan, and yet, pain is perhaps the least understood comorbidity in these populations. The objective of this study was to compare the prevalence and types of pain diagnosed among adults living with and without CP or SB. In this retrospective cohort study, we analyzed data from a nationwide commercial insurance claims database. Beneficiaries were included if they had an International Classification of Diseases, Ninth revision, Clinical Modification diagnosis code for CP or SB (n = 22,648). Adults without CP or SB were also included as controls (n = 931,623). Pain phenotypes (nociceptive, nociplastic, and neuropathic pain) and pain multimorbidity (≥2 conditions) were compared. We found that adults living with CP or SB had a higher prevalence of any pain disorders (55.9% vs 35.2%), nociceptive pain (44.0% vs 26.7%), nociplastic pain (26.1% vs 11.9%), neuropathic pain (9.6% vs 5.6%), and pain multimorbidity (21.1% vs 8.4%), as compared to adults without CP or SB, and differences were to a clinically meaningful extent. Adjusted odds ratios of nociceptive pain (odds ratio [OR]: 2.20; 95% confidence interval [CI]: 2.15-2.24), nociplastic pain (OR: 2.47; 95% CI: 2.41-2.53), neuropathic pain (OR: 2.71; 95% CI: 2.54 -2.89), and other pain (OR: 3.92; 95% CI: 3.67-4.19) were significantly higher for adults living with CP or SB. In conclusion, adults with CP or SB have a significantly higher prevalence and odds of common peripheral, central, and neuropathic pain disorders and pain multimorbidity, as compared to adults without CP or SB.

PMID: 34534178

7. [Challenges in pain assessment and management among individuals with intellectual and developmental disabilities : German version] [Article in German]
Chantel C Barney, Randi D Andersen, Ruth Defrin, Lara M Genik, Brian E McGuire, Frank J Symons

Review Schmerz. 2021 Sep 13. doi: 10.1007/s00482-021-00589-8. Online ahead of print.

Introduction: Intellectual and developmental disabilities (IDD) include conditions associated with physical, learning, language, behavioural, and/or intellectual impairment. Pain is a common and debilitating secondary condition compromising functional abilities and quality of life. Objectives: This article addresses scientific and clinical challenges in pain assessment and management in individuals with severe IDD. Methods: This Clinical Update aligns with the 2019 IASP Global Year Against Pain in the Vulnerable and selectively reviews recurring issues as well as the best available evidence and practice. Results: The past decade of pain research has involved the development of standardized assessment tools appropriate for individuals with severe IDD; however, there is little empirical evidence that pain is being better assessed or managed clinically. There is limited evidence available to inform effective pain management practices; therefore, treatment approaches are largely empiric and highly variable. This is problematic because individuals with IDD are at risk of developing drug-related side effects, and treatment approaches effective for other populations may exacerbate pain in IDD populations. Scientifically, we are especially challenged by biases in self-reported and proxy-reported pain scores, identifying valid outcome measures for treatment trials, being able to adequately power studies due to small sample sizes, and our inability to easily explore the underlying pain mechanisms due to compromised ability to self-report. Conclusion: Despite the critical challenges, new developments in research and knowledge translation activities in pain and IDD continue to emerge, and there are ongoing international collaborations.

PMID: 34515871

8. Toward Evaluation of the Subjective Experience of a General Class of User-Controlled, Robot-Mediated Rehabilitation Technologies for Children with Neuromotor Disability
Manon Maitland Schladen, Kevin Cleary, Yiannis Koumpouros, Reza Monfaredi, Tyler Salvador, Hadi Fooladi Talari, Jacob Slagle, Catherine Coley, Staci Kovelman, Justine Belschner, Sarah Helen Evans

Informatics (MDPI). 2020;7(4):45-50. doi: 10.3390/informatics7040045.

Technological advances in game-mediated robotics provide an opportunity to engage children with cerebral palsy (CP) and other neuromotor disabilities in more frequent and intensive therapy by making personalized, programmed interventions available 24/7 in children's homes. Though shown to be clinically effective and feasible to produce, little is known of the subjective factors impacting acceptance of what we term assistive/rehabilitative (A/R) gamebots by their target populations. This research describes the conceptualization phase of an effort to develop a valid and reliable instrument to guide the design of A/R gamebots. We conducted in-depth interviews with 8 children with CP and their families who had trialed an exemplar A/R gamebot, PedBotHome, for 28 days in their homes. The goal was to understand how existing theories and instruments were either appropriate or inappropriate for measuring the subjective experience of A/R gamebots. Key findings were the importance of differentiating the use case of therapy from that of assistance in rehabilitative technology assessment, the need to incorporate the differing perspectives of children with CP and those of their parents into A/R gamebot evaluation, and the potential conflict between the goals of preserving the quality of the experience of game play for the child while also optimizing the intensity and duration of therapy provided during play.

PMID: 34522643

9. Mortality and significant neurosensory impairment in preterm infants: an international comparison
Marie Chevallier, Thierry Debillon, Brian A Darlow, Anne R Synnes, Véronique Pierrat, Elizabeth Hurrion, Junmin Yang, Anne Ego, Pierre Yves Ancel, Kei Lui, Prakeshkumar S Shah, Thuy Mai Luu, Australian and New Zealand Neonatal Network (ANZNN); Canadian Neonatal Network (CNN); Canadian Neonatal Follow-Up Network (CNFUN); Etude Epidémiologique sur les Petits Ages Gestationnels (EPIPAGE-2) Investigators

Arch Dis Child Fetal Neonatal Ed. 2021 Sep 11;fetalneonatal-2021-322288. doi: 10.1136/archdischild-2021-322288. Online ahead of print.

Objective: To compare mortality and rates of significant neurosensory impairment (sNSI) at 18-36 months' corrected age in infants born extremely preterm across three international cohorts. Design: Retrospective analysis of prospectively collected neonatal and follow-up data. Setting: Three population-based observational cohort studies: the Australian and New Zealand Neonatal Network (ANZNN), the Canadian Neonatal and Follow-up Networks (CNN/CNFUN) and the French cohort Etude (Epidémiologique sur les Petits Ages Gestationnels: EPIPAGE-2). Patients: Extremely preterm neonates of <28 weeks' gestation in year 2011. Main outcome measures: Primary outcome was composite of mortality or sNSI defined by cerebral palsy with no independent walking, disabling hearing loss and bilateral blindness. Results: Overall, 3055 infants (ANZNN n=960, CNN/CNFUN n=1019, EPIPAGE-2 n=1076) were included in the study. Primary composite outcome rates were 21.3%, 20.6% and 28.4%; mortality rates were 18.7%, 17.4% and 26.3%; and rates of sNSI among survivors were 4.3%, 5.3% and 3.3% for ANZNN, CNN/CNFUN and EPIPAGE-2, respectively. Adjusted for gestational age and multiple births, EPIPAGE-2 had higher odds of composite outcome compared with ANZNN (OR 1.71, 95% CI 1.38 to 2.13) and CNN/CNFUN (OR 1.72, 95% CI 1.39 to 2.12). EPIPAGE-2 did have a trend of lower odds of sNDI but far short of compensating for the significant increase in mortality odds. These differences may be related to variations in perinatal approach and practices (and not to differences in infants' baseline characteristics). Conclusions: Composite outcome of mortality or sNSI for extremely preterm infants differed across high-income countries with similar baseline characteristics and access to healthcare.

PMID: 34509987

10. Variation in disease in children according to immigrant background
Marte Kjøllesdal, Angela S Labberton, Anne Reneflot, Lars J Hauge, Samera Qureshi, Pål Surén

Scand J Public Health. 2021 Sep 11;14034948211039397. doi: 10.1177/14034948211039397. Online ahead of print.

Background: A growing proportion of children born in Europe are born to immigrant parents. Knowledge about their health is essential for preventive and curative medicine and health services planning. Objective: To investigate differences in diagnoses given in secondary and tertiary healthcare between Norwegian-born children to immigrant and non-immigrant parents. Methods: Data from the Medical Birth Registry of Norway, the Norwegian Patient Registry and Statistics Norway were linked by the national personal identification number. The study population included children born in Norway aged 0-10 years between 2008 and 2018 (N=1,015,267). Diagnostic categories from three main domains of physical health, given in secondary or tertiary care; infections, non-infectious medical conditions and non-infectious neurological conditions were included from 2008 onwards. Hazards of diagnoses by immigrant background were assessed by Cox regressions adjusted for sex and birth year. Results: Children of immigrants generally had higher hazards than children with Norwegian background of some types of infections, obesity, nutrition-related disorders, skin diseases, blood disease and genital disease. Children of immigrants from Africa also had higher hazards of cerebral palsy, cerebrovascular diseases and epilepsy. Conversely, most groups of children of immigrants had lower hazards of acute lower respiratory tract infections, infections of the musculoskeletal system, infections of the central nervous system, diseases of the circulatory system, hearing impairment, immune system disorders, chronic lower respiratory disease and headache conditions. Conclusions: Children of immigrants did not present with overall worse health than children without immigrant background, but the distribution of health problems varied between groups.

PMID: 34510980

11. Yield of clinically reportable genetic variants in unselected cerebral palsy by whole genome sequencing
C L van Eyk, D L Webber, A E Minoche, L A Pérez-Jurado, M A Corbett, A E Gardner, J G Berry, K Harper, A H MacLennan, J Gecz

NPJ Genom Med. 2021 Sep 16;6(1):74. doi: 10.1038/s41525-021-00238-0.

Cerebral palsy (CP) is the most common cause of childhood physical disability, with incidence between 1/500 and 1/700 births in the developed world. Despite increasing evidence for a major contribution of genetics to CP aetiology, genetic testing is currently not performed systematically. We assessed the diagnostic rate of genome sequencing (GS) in a clinically unselected cohort of 150 singleton CP patients, with CP confirmed at >4 years of age. Clinical grade GS was performed on the proband and variants were filtered, and classified according to American College of Medical Genetics and Genomics-Association for Molecular Pathology (ACMG-AMP) guidelines. Variants classified as pathogenic or likely pathogenic (P/LP) were further assessed for their contribution to CP. In total, 24.7% of individuals carried a P/LP variant(s) causing or increasing risk of CP, with 4.7% resolved by copy number variant analysis and 20% carrying single nucleotide or indel variants. A further 34.7% carried one or more rare, high impact variants of uncertain significance (VUS) in variation intolerant genes. Variants were identified in a heterogeneous group of genes, including genes associated with hereditary spastic paraplegia, clotting and thrombophilic disorders, small vessel disease, and other neurodevelopmental disorders. Approximately 1/2 of individuals were classified as likely to benefit from changed clinical management as a result of genetic findings. In addition, no significant association between genetic findings and clinical factors was detectable in this cohort, suggesting that systematic sequencing of CP will be required to avoid missed diagnoses.

PMID: 34531397

12. Neonatal stroke: Clinical characteristics and neurodevelopmental outcomes
Marwa M Elgendy, Subhash Puthuraya, Carmela LoPiccolo, Wei Liu, Hany Aly, Sreenivas Karnati

Pediatr Neonatol. 2021 Aug 28;S1875-9572(21)00160-1. doi: 10.1016/j.pedneo.2021.06.017. Online ahead of print.

Background: Neonatal stroke can potentially result in significant neurological sequelae in affected infants. Studies on neurodevelopmental outcomes and the need for rehabilitation therapies in the first two years are limited. We aimed to describe the clinical characteristics, diagnostic evaluation, and neurodevelopmental outcomes of a cohort of infants with neonatal stroke. Methods: A retrospective cohort study of infants with neonatal stroke, from 2011 to 2020. Maternal and infant characteristics were described. Placental pathology, echocardiogram results, and prothrombotic evaluations were reported. The neurodevelopmental outcomes using Bayley scale of infant development (BSID III), rates of epilepsy and cerebral palsy, and the need for rehabilitation therapies at two years were described. Results: During the study period, 55 infants had neonatal stroke. Majority (93%) were term or late preterm infants. Maternal chorioamnionitis and perinatal HIE were diagnosed in about a third of the infants. Most (66%) of the infants presented with seizures. On brain MRI, the lesions were unilateral in 76% and arterial in origin in 86% of the infants. Meconium exposure (42%), intrauterine inflammation/infection (37%) and fetal

vascular malperfusion (16%) were seen on placental histopathology. At two-year BSID III assessment, median (min, max) composite cognitive, language, and motor scores were 100 (55-145), 97 (47-124), and 100 (46-141), respectively. Among this cohort, epilepsy (27%), cerebral palsy (16%) and the need for rehabilitation therapies (physical -24%, occupational -18%, speech -21%) were reported at two years. Conclusion: Neonatal stroke presented commonly in term or late preterm infants with seizures. It was unilateral and arterial in origin in most infants. Maternal chorioamnionitis and perinatal HIE were the most commonly associated conditions at birth. About one-fifth of the infants had mild or severe developmental delays at two years. Epilepsy, cerebral palsy, and need for rehabilitation therapies were noted in a significant proportion of infants at two years.

PMID: 34509386

13. Perinatal and long-term outcomes of fetal intracranial hemorrhage: systematic review and meta-analysis
F G Sileo, J Zollner, F D'Antonio, S Islam, A T Papageorghiou, A Khalil

Review Ultrasound Obstet Gynecol. 2021 Sep 16. doi: 10.1002/uog.24766. Online ahead of print.

Objective: Fetal intracranial hemorrhage is associated with increased risk of perinatal mortality and morbidity. Healthcare professionals often find it challenging to counsel parents due to its rarity and diverse presentation. The aim of this systematic review and meta-analysis was to investigate the perinatal outcomes of fetuses with intracranial hemorrhage. Methods: Medline, Embase, Clinicaltrials.gov and Cochrane Library databases were searched. Inclusion criteria were studies reporting the outcomes of fetuses diagnosed with intracranial hemorrhage. The primary outcome was perinatal death (PND) defined as the sum of intra-uterine (IUD) and neonatal death (NND). The secondary outcomes were stillbirth, NND, termination of pregnancy, need for surgery/shunting at birth, cerebral palsy, defined according to the European Cerebral Palsy Network and classified as diplegia, hemiplegia, quadriplegia, dyskinetic, or mixed, neurodevelopmental delay, and intact survival. All these outcomes were explored in the overall population of fetuses with intracranial hemorrhage. A subgroup analysis according to the location of the hemorrhage (intra-axial and extra-axial) was also planned. Meta-analyses of proportions were used to combine data and reported pooled proportion and their 95% confidence intervals (CI). Results: Sixteen studies (193 fetuses) were included in the analysis. PND occurred in 14.6% (95% CI 7.3-24.0), of fetuses with intracranial hemorrhage. Of those liveborn, 27.6% (95% CI 12.5-45.9) required shunt placement after birth and 32.0% (95% CI 22.2-42.6) had cerebral palsy. 16.7% of children had signs of mild neurodevelopmental delay, while 31.1% (95% CI 19-44.7) experienced severe adverse neurodevelopmental outcome. A normal outcome was reported in 53.6% of the fetuses. Subgroup analysis according to the location of the intracranial hemorrhage showed that PND occurred in 13.3% (95% CI 5.7-23.4) of fetuses with intra-axial and in 26.7% (95% CI 5.3-56.8) with extra-axial bleeding. In fetuses with intra-axial hemorrhage 24.7% (95% CI 11-41.2) required shunt placement after birth and 27.1% (95% CI 17.1-38.4) experienced cerebral palsy. Mild and severe neurodevelopmental delay were observed in 15% (95% CI 6.9-25.6) and 32.3% (95% CI 19.7-46.3) of cases, respectively, while 51.9% (95% CI 36-67.4) experienced a normal neurodevelopmental outcome. Robust evidence on the incidence of mortality and postnatal outcome in fetuses with extra-axial hemorrhage could not be extrapolated due to the small number of cases. Conclusions: Fetuses with a prenatal diagnosis of intracranial hemorrhage are at high risk of perinatal morality and impaired neurodevelopmental outcome. Postnatal shunt placement was performed in 28% and cerebral palsy was diagnosed in approximately one third of these infants. This article is protected by copyright. All rights reserved.

PMID: 34529308

14. Intrauterine drug exposure as a risk factor for cerebral palsy
Kristen L Benninger, Jessica Purnell, Sara Conroy, Kenneth Jackson, Nancy Batterson, Mary Lauren Neel, Mark E Hester, Nathalie L Maitre, NCH Early Developmental Group

Dev Med Child Neurol. 2021 Sep 16. doi: 10.1111/dmcn.15050. Online ahead of print.

Aim: To determine whether infants with intrauterine drug exposure (IUDE) are similarly at risk for cerebral palsy (CP) as other high-risk populations, whether CP classification differs based on IUDE status, and describe the association of CP with specific substances among exposed infants. Method: This was a retrospective analysis of infants in a high-risk follow-up program (n=5578) between January 2014 and February 2018 with a history of IUDE or who received a CP diagnosis. CP rates were compared using two-sample z-tests. CP classification was assessed using Fisher's exact, Cochran-Armitage, and Wilcoxon rank-sum tests. Models for CP risk were assessed using multivariable logistic regression. Results: Among all infants with IUDE (n=1086), 53.8% were male with a mean (SD) birth gestational age of 36.8 (3.6) weeks. Among unexposed infants with CP (n=259), 54.4% were male with a mean (SD) birth gestational age of 29.9 (5.7) weeks. Opioids were the most common

exposure (93.7%) of all infants with IUDE. The CP rate in the IUDE (5.2%) and unexposed (5.7%) high-risk populations were not significantly different (p=0.168), nor were there differences in CP typology, topography, or severity between exposed (n=57) and unexposed (n=259) infants (all p>0.05). In patients with IUDE and after controlling for established CP risk factors, the observed odds of CP varied among substances. Interpretation: We suggest that IUDE should be considered a 'newborn-detectable risk' in the guidelines for the early detection of CP.

PMID: 34528707

15. Appraisal of Clinical Practice Guideline: Early intervention for children aged 0 to 2 years with or at high risk of cerebral palsy: International clinical practice guideline based on systematic reviews
Emre Ilhan, Leanne M Johnston

J Physiother. 2021 Sep 9;S1836-9553(21)00091-6. doi: 10.1016/j.jphys.2021.08.011. Online ahead of print.

PMID: 34511386

16. Comprehensive approach to children with cerebral palsy
María José Peláez Cantero, Esther Eugenia Moreno Medinilla, Ana Cordón Martínez, Silvia Gallego Gutiérrez

An Pediatr (Engl Ed). 2021 Sep 12;S2341-2879(21)00152-6. doi: 10.1016/j.anpede.2021.07.002. Online ahead of print.

Infantile cerebral palsy is one of the most prevalent diseases and the most frequent cause of disability in paediatrics. Children with cerebral palsy have complex health care needs and often require the care of a multidisciplinary team. However, in many cases there is no paediatrician with overall responsibility for coordinating follow-up. We have produced a support document intended for paediatricians coordinating the care of children with cerebral palsy. Our aim is to provide an ordered compilation of the main issues these patients may develop, to know how to identify and address them if necessary, and to establish criteria for referring these patients to other specialists.

PMID: 34526244

17. Effect of Anodal Transcranial Direct Current Stimulation Combined With Cognitive Training for Improving Cognition and Language Among Children With Cerebral Palsy With Cognitive Impairment: A Pilot, Randomized, Controlled, Double-Blind, and Clinical Trial
Eun Jae Ko, Mi Jin Hong, Eun Jung Choi, Jin Sook Yuk, Mi Sun Yum, In Young Sung

Front Pediatr. 2021 Aug 25;9:713792. doi: 10.3389/fped.2021.713792. eCollection 2021.

About 30-45% of cerebral palsy (CP) patients have cognitive impairment. Previous studies showed the evidence that transcranial direct current stimulation (tDCS) may have some benefits in attention-deficit/hyperactivity disorder, autism spectrum disorder, and motor development in CP. The aim of this study is to evaluate the effect of tDCS on cognition, language, and activities of daily living (ADL) among children with CP with cognitive impairment. It was a pilot, randomized, controlled, double-blind, clinical trial in a tertiary pediatric hospital, and 13 children with CP and a cognitive age under 42 months were enrolled. tDCS group (n = 8) had active tDCS and cognitive training (20 min/session, total 20 sessions, for 12 weeks) and sham group (n = 5) had sham tDCS and cognitive training. Primary outcome was the Bayley Scales of Infant Development II (BSID II). Secondary outcomes were the Pediatric Evaluation of Disability Inventory (PEDI), the Laboratory Temperament Assessment Battery (Lab-TAB), the Early Childhood Behavior Questionnaire (ECBQ), the Korean version of MacArthur-Bates Communicative Development Inventories (M-B CDI-K), the Sequenced Language Scale for Infants (SELSI) and the Preschool Receptive-Expressive Language Scale (PRES). After intervention, the tDCS group showed significant improvements in all measurements ($p < 0.05$) except the M-B CDI-K (grammar), whereas the sham group only showed significant improvements in the Lab-TAB (manipulation domain), the ECBQ (attentional shifting), and the M-B CDI-K (comprehension). The between-group differences in the degree of post-intervention improvement were not statistically significant. The degree of improvement was associated with better baseline cognitive function and younger age ($p < 0.05$).

There were no major adverse events after tDCS. The combined application of tDCS and cognitive training was feasible and associated with improvements in cognitive function, ADL, and language among children with CP with cognitive impairment. However, considering that it is a pilot study, further larger-scale systematic investigation is needed. Clinical Trial Registration: The trial was registered in the Clinical Research Information Service database, identifier: KCT0003023.

PMID: 34513765

18. Cerebral Palsy and Rehabilitative Care: The Role of Home-Based Care and Family-Centered Approach
Sonika Agarwal, Mark S Scher, Ann Tilton

Indian Pediatr. 2021 Sep 15;58(9):813-814.

PMID: 34508333

19. Using the PODCI to Measure Motor Function and Parent Expectations in Children with Cerbral Palsy
Kimberley S Scott, Gardenia O Barbosa, Jeff Pan, Jill C Heathcock

Phys Ther. 2021 Sep 15;pzab215. doi: 10.1093/ptj/pzab215. Online ahead of print.

Objective: Involving parents in the evaluation of their child with cerebral palsy (CP) is associated with enhanced neurodevelopmental outcomes. The pediatric outcomes data collection instrument (PODCI) is a patient-reported outcome measure primarily used to assess motor function following orthopedic surgical intervention or for older children with more independent motor function. The PODCI expectations scale has infrequently been reported in previous studies. This study aims to determine the relationship between parent-reported motor performance using the PODCI and motor capacity assessed by pediatric therapists for young children with CP across all ability levels and to explore the use of the PODCI expectations scale for quantifying therapy-related parent expectations. Methods: This prospective cohort study included 108 participants with CP, 2 to 8 years of age, gross motor function classification systems (GMFCS) levels I to V. Measures included the PODCI, gross motor function measure (GMFM), and GMFCS. Results: There were moderate ($r = 0.513$) to large ($r = 0.885$) relationships between PODCI and GMFM scores. PODCI scores were significantly different across GMFCS levels. Weak, significant relationships ($r = -0.28$) were found between function expectations scores and measures of function. Conclusion: The PODCI, GMFM, and GMFCS provide different, but strongly related, information about the abilities of young children. The GMFM measures motor capacity. Parents report daily function and health-related quality of life for their child using the PODCI. Parent expectations for intervention outcomes may relate to a child's motor function. Impact: These study results are consistent with those for older children with greater independent mobility, indicating an opportunity for expanded use of the PODCI for measuring motor performance for younger children with CP across all ability levels. A strategy is provided for using the PODCI expectations scale to quantify parent therapy-related expectations in future research and clinical settings. Therapy-related expectations may relate to child outcomes.

PMID: 34529078

20. Aging With Cerebral Palsy: A Photovoice Study Into Citizenship
Vera G van Heijningen, Mieke Cardol, Heidi J M van Heijningen-Tousain, Daniëlla M Oosterveer, Frederike van Markus-Doornbosch, Jane N T Sattoe, Menno van der Holst, Sander R Hilberink

Front Neurol. 2021 Aug 31;12:729509. doi: 10.3389/fneur.2021.729509. eCollection 2021.

Background: Adults with cerebral palsy (CP) may experience an increasing impact of their disability on daily life and this may interfere with their citizenship. Citizenship is a layered construct. Next to formal and theoretical significations, and civil rights acts such as the UN Convention on the Rights for Persons with Disabilities (CRPD), the meaning of citizenship is formed by the person themselves. The present study aimed to gain insight into what citizenship means for adults with CP 40 years or older and what is needed to support and pursue their citizenship to improve person-centered rehabilitation which can facilitate this process. Methods: Adults with CP (>40 years) without intellectual disability were recruited from medical records of a large

rehabilitation center to participate in a qualitative study using the photovoice method. Participants were asked to take photos of objects or life situations that constituted citizenship for them; these photos were then the prompts for the semi-structured interviews that were held face-to-face at their homes. Background and clinical characteristics were gathered using a short face-to-face questionnaire. Data were analyzed through inductive thematic analysis. Results: Nineteen adults participated [mean age (SD) 57.8 (9.4) years (range 44-79), six men]. From the analysis four themes emerged: (a) Meanings of citizenship; (b) Citizenship: Facilitator and barriers; (c) Paradoxes of support and participation; and (d) Future. Furthermore, next to the ability to participate in society without restrictions, sense of belonging was reported to be an important aspect of "meanings of citizenship." The physiotherapist was perceived as an important health professional to maintain physical activity and deal with the impact of aging with CP on daily activities. Complex healthcare and support services regulations and aging affected citizenship negatively. Conclusion: Middle-aged and older adults with CP view citizenship as the ability to participate and belong in society. To optimize their citizenship the challenges and individual needs must be seen and supported by person-centered rehabilitation and support services. Simplification of complex healthcare and services regulations can further improve citizenship.

PMID: 34531818

21. A Coupled Mechanobiological Model of Muscle Regeneration In Cerebral Palsy
Stephanie Khuu, Justin W Fernandez, Geoffrey G Handsfield

Front Bioeng Biotechnol. 2021 Aug 27;9:689714. doi: 10.3389/fbioe.2021.689714. eCollection 2021.

Cerebral palsy is a neuromusculoskeletal disorder associated with muscle weakness, altered muscle architecture, and progressive musculoskeletal symptoms that worsen with age. Pathological changes at the level of the whole muscle have been shown; however, it is unclear why this progression of muscle impairment occurs at the cellular level. The process of muscle regeneration is complex, and the interactions between cells in the muscle milieu should be considered in the context of cerebral palsy. In this work, we built a coupled mechanobiological model of muscle damage and regeneration to explore the process of muscle regeneration in typical and cerebral palsy conditions, and whether a reduced number of satellite cells in the cerebral palsy muscle environment could cause the muscle regeneration cycle to lead to progressive degeneration of muscle. The coupled model consisted of a finite element model of a muscle fiber bundle undergoing eccentric contraction, and an agent-based model of muscle regeneration incorporating satellite cells, inflammatory cells, muscle fibers, extracellular matrix, fibroblasts, and secreted cytokines. Our coupled model simulated damage from eccentric contraction followed by 28 days of regeneration within the muscle. We simulated cyclic damage and regeneration for both cerebral palsy and typically developing muscle milieus. Here we show the nonlinear effects of altered satellite cell numbers on muscle regeneration, where muscle repair is relatively insensitive to satellite cell concentration above a threshold, but relatively sensitive below that threshold. With the coupled model, we show that the fiber bundle geometry undergoes atrophy and fibrosis with too few satellite cells and excess extracellular matrix, representative of the progression of cerebral palsy in muscle. This work uses in silico modeling to demonstrate how muscle degeneration in cerebral palsy may arise from the process of cellular regeneration and a reduced number of satellite cells.

PMID: 34513808