Cerebral palsy research news

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Professor Nadia Badawi AM
CP Alliance Chair of Cerebral Palsy Research

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Interventions and Management

1. Topical Review: Approach to Diagnosis and Management of the Pediatric Foot and Ankle in Cerebral Palsy Patients
Sean A Tabaie, Anthony J Videckis, Theodore Quan, Evan D Sheppard

Review Foot Ankle Orthop. 2022 Apr 22;7(2):24730114221091800. doi: 10.1177/24730114221091800. eCollection 2022 Apr.

No abstract available

PMID: 35479332

2. Mental Health Benefits of Physical Activity in Youth with Cerebral Palsy: A Scoping Review
Jessica Starowicz, Karen Pratt, Carly McMorris, Laura Brunton

Phys Occup Ther Pediatr. 2022 Apr 28;1-17. doi: 10.1080/01942638.2022.2060058. Online ahead of print.

Aims: Children and adolescents with cerebral palsy (CP) are at heightened risk for mental health problems. Physical activity is an effective strategy to promote quality of life (QoL) and reduce mental health symptoms along with evidence-based therapies. This study described existing literature examining the mental health outcomes (e.g., QoL, well-being, anxiety, and depression) of physical activity interventions in children and adolescents with CP to help inform the implementation of physical activity interventions for this population. Methods: A scoping review framework was used to map the existing quantitative literature. Results: The search returned 243 articles; after titles, abstracts, and full manuscripts were reviewed, 21 articles were included. The association between physical activity and QoL was examined in most studies (n = 17) with mixed findings. Eight studies documented at least one significant positive association between physical activity and QoL, and four found that physical activity interventions were highly enjoyable. Only one study assessed anxiety and/or depression following a PA intervention. Conclusions: Physical activity may benefit aspects of QoL and mental health symptoms; however, this was not a consistent finding in the existing literature. Along with other therapies, physical activity interventions may be valuable in improving QoL, and in turn, the mental health symptoms of children with CP.

PMID: 35484717

3. Psychosocial Intervention Outcomes for Children with Congenital and Neonatal Conditions: Systematic Review
Bronwyn Lamond, Samantha D Roberts, Steven P Miller, Shari L Wade, Tricia S Williams

J Pediatr Psychol. 2022 Apr 26;jsac038. doi: 10.1093/jpepsy/jsac038. Online ahead of print.
There has been a historic lack of psychosocially geared treatment studies for congenital and neonatal conditions that impact brain development, despite well-established knowledge that these conditions impact cognitive development, quality of life (QoL), mental health, and academic success. Objective: The aim of the present study was to systematically investigate the research literature focusing on the effects of interventions in psychosocially geared programs for children with neonatal brain injury on school and psychological outcomes. Methods: Psychosocially geared programs broadly refer to interventions to improve parenting and school functioning, or child behavior, as well as other interventions that have a psychological component but may be more physically oriented, such as goal-directed physiotherapy. A comprehensive search of PubMed, Medline, PsychINFO, and Embase was completed between June and July 2020. The methodological quality of included articles was assessed using the Cochrane Risk of Bias Tool for Randomized Trials (RoB-2). Results and conclusion: Twenty studies met the inclusion criteria and demonstrated adequate risk of bias (i.e., low risk of bias or some concerns). The studies included family (n = 2), parenting (n = 7), and child (n = 10) interventions. There is some evidence supporting the effectiveness of psychosocial interventions for children with neonatal brain injury and their families on academic outcomes, behavior, and QoL, indicated by positive intervention effects in 65% (n = 13) of studies.

PMID: 35472174

4. From Mouth to Brain: Distinct Supragingival Plaque Microbiota Composition in Cerebral Palsy Children With Caries
Mingxiao Liu, Yuhan Shi, Kaibin Wu, Wei Xie, Hooi-Leng Ser, Qianzhou Jiang, Lihong Wu

Front Cell Infect Microbiol. 2022 Apr 11;12:814473. doi: 10.3389/fcimb.2022.814473. eCollection 2022.

Children with cerebral palsy (CP) present a higher prevalence and severity of caries. Although researchers have studied multiple risk factors for caries in CP, the role of microorganisms in caries remains one of the critical factors worth exploring. In order to explore the differences in the supragingival plaque microbiota (SPM), supragingival plaque samples were collected from 55 CP children and 23 non-CP children for 16S rRNA sequencing. Distinct SPM composition was found between CP children with severe caries (CPCS) and non-CP children with severe caries (NCPCS). Further subanalysis was also done to identify if there were any differences in SPM among CP children with different degrees of caries, namely, caries-free (CPCF), mild to moderate caries (CPCM), and severe caries (CPCS). After selecting the top 15 most abundant species in all groups, we found that CPCS was significantly enriched for Fusobacterium nucleatum, Prevotella intermedia, Campylobacter rectus, Porphyromonas endodontalis, Catonella morbi, Alloprevotella tannerae, Parvimonas micra, Streptobacillus moniliformis, and Porphyromonas canoris compared to NCPCS. By comparing CPCF, CPCM, and CPCS, we found that the core caries-associated microbiota in CP children included Prevotella, Alloprevotella, Actinomyces, Catonella, and Streptobacillus, while Capnocytophaga and Campylobacter were dental health-associated microbiota in CP children. Alpha diversity analysis showed no significant difference between NCPCS and CPCS, but the latter had a much simpler core correlation network than that of NCPCS. Among CP children, CPCM and CPCF displayed lower bacterial diversity and simpler correlation networks than those of CPCS. In summary, the study showed the specific SPM characteristics of CPCS compared to NCPCS and revealed the core SPM in CP children with different severities of caries (CPCF, CPCM, and CPCS) and their correlation network. Hopefully, the study would shed light on better caries prevention and therapies for CP children. Findings from the current study offer exciting insights that warrant larger cohort studies inclusive of saliva and feces samples to investigate the potential pathogenic role of oral microbiota through the oral-gut-brain axis in CP children with caries.

PMID: 35480234

5. Urodynamic study findings and related influential factors in pediatric spastic cerebral palsy
Wenbin Jiang, Huizhen Sun, Baojun Gu, Qijia Zhan, Min Wei, Sen Li, Fang Chen, Bo Xiao

Sci Rep. 2022 Apr 28;12(1):6962. doi: 10.1038/s41598-022-11057-3.

To investigate the urodynamic study (UDS) result in pediatric patients suffering from spastic cerebral palsy (CP). Medical records of patients diagnosed CP having pre-operative UDS results underwent selective dorsal rhizotomy (SDR) from Jan.

2020 to May. 2021 were retrospectively reviewed. Fifty-seven cases diagnosed spastic CP were included in the study (mean age, 6.73 ± 2.84 years), among which, 46 were ambulatory and 11 non-ambulatory. Average gross motor function measure-66 (GMFM-66) score was 62.16 ± 11.39. Reduced bladder capacity was seen in 49.12% of these cases and cases with lower GMFM-66 score possessed a higher incidence rate of having low bladder capacity ($p < 0.01$). Detrusor overactivity (DO) was shown in 33.33% of the patients. Cases with younger age presented a higher prevalence of DO ($p < 0.05$). Meanwhile, more non-ambulant patients suffered from DO ($p < 0.05$). Increased post-voiding residual (PVR) was seen in 21.05% of the cases. Those with higher average threshold in sphincter-associated input spinal nerve roots (rootlets) witnessed a higher rate of having abnormal PVR ($p < 0.05$). Abnormal UDS results were prevalent in pediatric patients suffering from CP. Motor function, age and threshold of their sphincter-associated spinal nerve roots laid corresponding effect on the abnormal UDS results.

PMID: 35484196

6. Quantitative MRI Characterization of the Extremely Preterm Brain at Adolescence: Atypical versus Neurotypical Developmental Pathways
Ryan McNaughton, Chris Pieper, Osamu Sakai, Julie V Rollins, Xin Zhang, David N Kennedy, Jean A Frazier, Laurie Douglass, Timothy Heeren, Rebecca C Fry, T Michael O'Shea, Karl K Kuban, Hernán Jara, ELGAN-ECHO Study Investigators

Radiology. 2022 Apr 26;210385. doi: 10.1148/radiol.210385. Online ahead of print.

Background Extremely preterm (EP) birth is associated with higher risks of perinatal white matter (WM) injury, potentially causing abnormal neurologic and neurocognitive outcomes. MRI biomarkers distinguishing individuals with and without neurologic disorder guide research on EP birth antecedents, clinical correlates, and prognoses. Purpose To compare multiparametric quantitative MRI (qMRI) parameters of EP-born adolescents with autism spectrum disorder, cerebral palsy, epilepsy, or cognitive impairment (ie, atypically developing) with those without (ie, neurotypically developing), characterizing sex-stratified brain development. Materials and Methods This prospective multicenter study included individuals aged 14-16 years born EP (Extremely Low Gestational Age Newborns-Environmental Influences on Child Health Outcomes Study, or ELGAN-ECHO). Participants underwent 3.0-T MRI evaluation from 2017 to 2019. qMRI outcomes were compared for atypically versus neurotypically developing adolescents and for girls versus boys. Sex-stratified multiple regression models were used to examine associations between spatial entropy density (SEd) and T1, T2, and cerebrospinal fluid (CSF)-normalized proton density (nPD), and between CSF volume and T2. Interaction terms modeled differences in slopes between atypically versus neurotypically developing adolescents. Results A total of 368 adolescents were classified as 116 atypically (66 boys) and 252 neurotypically developing (125 boys) participants. Atypically versus neurotypically developing girls had lower nPD (mean, 557 10 × percent unit [pu] ± 46 [SD] vs 573 10 × pu ± 43; P = .04), while atypically versus neurotypically developing boys had longer T1 (814 msec ± 57 vs 789 msec ± 82; P = .01). Atypically developing girls versus boys had lower nPD and shorter T2 (eg, in WM, 557 10 × pu ± 46 vs 580 10 × pu ± 39 for nPD [P = .006] and 86 msec ± 3 vs 88 msec ± 4 for T2 [P = .003]). Atypically versus neurotypically developing boys had a more moderate negative association between T1 and SEd (slope, -32.0 msec per kB/cm3 [95% CI: -49.8, -14.2] vs -62.3 msec per kB/cm3 [95% CI: -79.7, -45.0]; P = .03). Conclusion Atypically developing participants showed sexual dimorphisms in the cerebrospinal fluid-normalized proton density (nPD) and T2 of both white matter (WM) and gray matter. Atypically versus neurotypically developing girls had lower WM nPD, while atypically versus neurotypically developing boys had longer WM T1 and more moderate T1 associations with microstructural organization in WM. © RSNA, 2022 Online supplemental material is available for this article.

PMID: 35471112

7. Stem Cell Therapy for Neuroprotection in the Growth-Restricted Newborn
Kirat Chand, Rachel Nano, Julie Wixey, Jatin Patel

Review Stem Cells Transl Med. 2022 Apr 29;11(4):372-382. doi: 10.1093/stcltm/szac005.

Fetal growth restriction (FGR) occurs when a fetus is unable to grow normally due to inadequate nutrient and oxygen supply from the placenta. Children born with FGR are at high risk of lifelong adverse neurodevelopmental outcomes, such as cerebral palsy, behavioral issues, and learning and attention difficulties. Unfortunately, there is no treatment to protect the FGR newborn from these adverse neurological outcomes. Chronic inflammation and vascular disruption are prevalent in the brains of FGR neonates and therefore targeted treatments may be key to neuroprotection. Tissue repair and regeneration via stem cell therapies have emerged as a potential clinical intervention for FGR babies at risk for neurological impairment and long-term disability. This review discusses the advancement of research into stem cell therapy for treating neurological diseases and how

this may be extended for use in the FGR newborn. Leading preclinical studies using stem cell therapies in FGR animal models will be highlighted and the near-term steps that need to be taken for the development of future clinical trials.

PMID: 35485440

8. Safety and tolerability of a multilineage-differentiating stress-enduring cell-based product in neonatal hypoxic-ischaemic encephalopathy with therapeutic hypothermia (SHIELD trial): a clinical trial protocol open-label, non-randomised, dose-escalation trial
Nao Matsuyama, Shinobu Shimizu, Kazuto Ueda, Toshihiko Suzuki, Sakiko Suzuki, Ryosuke Miura, Akemi Katayama, Masahiko Ando, Masaaki Mizuno, Akihiro Hirakawa, Masahiro Hayakawa, Yoshiaki Sato

Clinical Trial BMJ Open. 2022 Apr 26;12(4):e057073. doi: 10.1136/bmjopen-2021-057073.

Introduction: Neonatal hypoxic-ischaemic encephalopathy (HIE) is an important illness associated with death or cerebral palsy. This study aims to assess the safety and tolerability of the allogenic human multilineage-differentiating stress-enduring cell (Muse cell)-based product (CL2020) cells in newborns with HIE. This is the first clinical trial of CL2020 cells in neonates. Methods and analysis: This is a single-centre, open-label, dose-escalation study enrolling up to 12 patients. Neonates with HIE who receive a course of therapeutic hypothermia therapy, which cools to a body temperature of 33°C-34°C for 72 hours, will be included in this study. A single intravenous injection of CL2020 cells will be administered between 5 and 14 days of age. Subjects in the low-dose and high-dose cohorts will receive 1.5 and 15 million cells per dose, respectively. The primary outcome is the occurrence of any adverse events within 12 weeks after administration. The main secondary outcome is the Bayley Scales of Infant and Toddler Development Third Edition score and the developmental quotient per the Kyoto Scale of Psychological Development 2001 at 78 weeks. Ethics and dissemination: This study will be conducted in accordance with the Declaration of Helsinki and Good Clinical Practice. The Nagoya University Hospital Institutional Review Board (No. 312005) approved this study on 13 November 2019. The results of this study will be published in peer-reviewed journal and reported in international conferences. Trial registration numbers: NCT04261335, jRCT2043190112.

PMID: 35473726

9. A rare cause of stroke in young children: minor head trauma associated with mineralising lenticulostriate angiopathy in three patients
Kiruthiga Sugumar, Aakash Chandran Chidambaram, Bobbity Deepthi, Sriram Krishnamurthy, C G Delhikumar

Paediatr Int Child Health. 2022 Apr 26;1-5. doi: 10.1080/20469047.2022.2066386. Online ahead of print.

Acute basal ganglia infarct following minor head trauma in association with mineralisation of lenticulostriate arteries is an increasingly recognised entity in childhood stroke. Three cases with a classical history and phenotypical features of mineralising angiopathy are described. Case 1 was a 2-year-old girl who presented with acute onset hemiparesis with a same-side upper motor neuron (UMN)-type facial palsy following minor head trauma. Case 2 was a 14-month-old boy who presented with a left side hemiparesis and a left UMN-type facial nerve palsy following a minor fall. Case 3 was an 8-month-old boy who, following a fall from his cot, had a sudden-onset hemiparesis on the right side and deviation of the angle of the mouth to the left. In brain computed tomography, all three cases demonstrated characteristic basal ganglia calcification of the mineralising angiopathy. Magnetic resonance imaging of the brain demonstrated features supportive of acute infarcts in the lentiform nucleus, caudate nucleus and putamen. Two of the patients had iron deficiency anaemia with haemoglobin of 7.0 g/dL and 7.8 g/dL, respectively. On follow-up, Case 1 had mild residual weakness and the other two made a complete recovery. None of the patients had a recurrence of stroke. Basal ganglia stroke with mineralising angiopathy should be considered in toddlers presenting with sudden-onset focal neurological deficits preceded by minor head trauma.Abbreviations: ADC: apparent diffusion coefficient; CT: computed tomography; DWI: diffusion-weighted imaging; Hb: haemoglobin; IDA: iron deficiency anaemia; MRI: magnetic resonance imaging; SLV: sonographic lenticulostriate vasculopathy; SWI: susceptibility weighted imaging; UMN: upper motor neuron.

PMID: 35471857

10. Moving into new housing designed for people with disability: preliminary evaluation of outcomes
Jacinta Douglas, Dianne Winkler, Stacey Oliver, Stephanie Liddicoat, Kate D'Cruz

Disabil Rehabil. 2022 Apr 27;1-9. doi: 10.1080/09638288.2022.2060343. Online ahead of print.

Purpose: To assess the change in individual outcomes for people with disability and complex needs after moving into newly built, individualised apartments in the community. Methods: People with disability (neurological disorder or cerebral palsy) and complex needs (n = 15, aged 18-65 years) completed quantitative self-report measures over two time-points (pre-move and 6-24 months post-move). Pre-move living arrangements included group homes, residential aged care, private rentals, and living with parents. Post-move living arrangements were individualised apartments built for people with disability. Health, wellbeing, community integration, and support needs were compared across pre- and post-move timepoints. Results: Paired sample t-tests showed significant improvements consistent with large effects in wellbeing (p = 0.031, Eta2=0.29) and community integration (p = 0.008, Eta2=0.41), particularly home integration, and a trend towards improved health (p = 0.077, Eta2=0.21). A Wilcoxon signed rank test demonstrated a trend towards reduced support needs (z= -1.941, p = 0.052) consistent with a medium effect (r = 0.35) and an average decrease of 2.4 support hours per participant per day. Conclusions: Well-located housing with appropriate design, technology and support provision makes a positive contribution to wellbeing, community integration, and health for people with complex disability. Implications for rehabilitation: People with disability who move into individualised apartments experience significant positive change in health, wellbeing, and participation. Findings highlight the benefits of housing that foster independence and enable personal choice and control. Evidence suggests that investment in appropriately designed and well-located housing has positive outcomes for people with disability. Evidence collected within this outcome framework has the potential to ensure models of housing and support that are responsive to the diverse and changing needs of people with disability.

PMID: 35476612