Cerebral palsy research news

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Interventions and Management

1. Hand use development in children with unilateral cerebral palsy
Gunvor L Klevberg, Reidun Jahnsen, Sonja Elkjaer, Manuela Zucknick

Dev Med Child Neurol. 2021 Jun 21. doi: 10.1111/dmcn.14957. Online ahead of print.

Aim: To describe the development of hand use during bimanual activities among children with unilateral cerebral palsy (CP). Method: A cohort of 166 children (79 females, 87 males; age range 18mo-13y, mean [SD] age at first assessment 37.6mo [20.5mo]) with unilateral CP, registered in the Norwegian CP Follow-up Program with two or more Assisting Hand Assessments (AHAs), were included in this longitudinal study comprising 524 AHAs. Developmental limits and rates were estimated by non-linear mixed effects models and compared between a stable limit model (SLM) and a peak and decline model. Development was described according to Manual Ability Classification System (MACS) levels and AHA performance at 18 months of age (AHA-18). Results: Children in MACS level I, or in the high AHA-18 group, reached highest limits and had the most rapid development ($p<0.001$). The developmental trajectories were different between MACS levels I, II, and III and between the high, moderate, and low AHA-18 groups. Seventy-five per cent of the children reached 90% of their estimated limit at 5 years 10 months or earlier. The SLM showed the best model fit (Akaike information criterion: 4008.99). Interpretation: Most children approached a steady performance limit before 6 years of age. Although children in MACS levels I and II reached 90% of the expected limit at 3 and 4 years respectively, the corresponding age was 8 years for children in MACS level III. The better model fit for the SLM indicates that children with unilateral CP maintain their attained limit of hand use to at least the age of 13 years.

PMID: 34152004

2. Commentary on "Effects of Orthoses on Standing Postural Control and Muscle Activity in Children With Cerebral Palsy"
Amanda Brinkman, Kelly Greve, Jessica Woodruff

Pediatr Phys Ther. 2021 Jul 1;33(3):136. doi: 10.1097/PEP.0000000000000803.

PMID: 34151888

3. Effect of whole-body vibration on abdominal thickness and sitting ability in children with spastic diplegia
Mostafa S Ali, Heba G Abd El-Aziz

J Taibah Univ Med Sci. 2020 Dec 19;16(3):379-386. doi: 10.1016/j.jtumed.2020.11.006. eCollection 2021 Jun.

Objective: Reduced muscle and bone mass, improper muscle function, and varying degrees of mobility dysfunctions are the main complications of cerebral palsy (CP). Many children with CP also present with poor abdominal muscle activation. Whole-body vibration (WBV) is a unique approach for enhancing strength and motor abilities in several clinical conditions. This study aimed to determine the influence of a 12-week WBV intervention on the thickness of the abdominal muscles and the sitting ability of children with diplegia. Methods: A total of 30 children with spastic diplegic CP (aged 4-6 years) were randomly divided into two groups (control and experimental). The control group received a selected physical therapy program for 1 h, and the study group received WBV training for 10 min in addition to the same selected program for the control group for 3 times/week over a period of 12 weeks. Thereafter, abdominal muscle thickness and sitting ability were measured using ultrasonography and the Gross Motor Function Measure-88 (GMFM-88, sitting domain). Results: Post treatment values revealed significant improvement in the measured variables in favour of the experimental group ($p < 0.05$), as there was improvement in the thickness of the four abdominal muscles compared to the control group (external oblique: $F = 38.783$; internal oblique: $F = 99.547$; transverse abdominis: $F = 111.557$, and rectus abdominis: $F = 129.940$, $p < 0.05$). Additionally, the study group showed a significantly greater improvement in GMFM-88 values compared to the control group ($F = 129.940$, $p < 0.05$). Conclusion: WBV can be a viable strategy for improving sitting ability and abdominal muscle thickness among children with spastic diplegia.

PMID: 34140865

4. Acute urinary retention in pediatric cerebral palsy: Is there an optimal management strategy?
Laura B Cornwell, Emily Ewing, Jeffrey Algra, George J Chiang

J Pediatr Urol. 2021 Jun 5;S1477-5131(21)00299-0. doi: 10.1016/j.jpurol.2021.05.028. Online ahead of print.

Introduction and objective: Cerebral palsy (CP) patients commonly have lower urinary tract dysfunction. Urinary retention (UR), which has been associated with dysfunctional voiding in CP can correlate to chronic upper tract dysfunction. We sought to provide insight into the pediatric presentation of acute UR in patients with CP and subsequent outcomes in this at-risk population. Study design: All children with perinatally acquired CP presenting to a regional health network were identified from 2009 to 2019. Retrospective analysis of a hospitalized subset concurrently diagnosed with a first episode of acute UR was performed. Factors associated with new-onset UR are described, as well as management. Using follow-up data, we also assessed the risk for recurrent UR and/or abnormal renal imaging after an initial UR presentation. Results: 3404 CP patients were analyzed with only 33 fulfilling inclusion criteria. Median age was 10(IQR 7.5-16; range 1-22) years, 87.9% were GMFCS-V. 39.4% had a reported history of decreased urinary frequency. At presentation, median maximal time without void prior to catheterization was 13 h, and catheterized volume was a median 120% expected capacity-for-age. 84.8% of presentations were associated with a known transient/reversible etiology. 51.5% were post-anesthesia at median 3.5 days, 33.3% had associated constipation, 30.3% had received exacerbating medications. 11/33 were taught clean intermittent catheterization (CIC) after the initial presentation (all pro re nata [PRN] except one). At a median follow-up of 37 months: 50% of those without a CIC PRN no void plan had a repeat episode, at a median of 10.8 months later. Of the patients who had follow-up renal imaging at a median 22.0 months after presentation, 45% had abnormalities: 7 with debris or suspected stones and 2 with collecting system dilation. No factors associated with the initial UR presentation were found to be significantly predictive of recurrence or abnormal follow-up imaging. Discussion: Patients with CP presenting with acute UR are often those with the most severe limitations and have a history of decreased urinary frequency. They usually have transient or reversible factors associated with UR presentation, however UR recurrence and abnormal imaging in this population subset is common. Conclusions: Pediatric patients with CP who present with acute UR usually present in the context of recent anesthesia and in the setting of exacerbating factors. They are at risk for recurrence and may be best managed with caretaker education of CIC PRN no void to address recurrent episodes. Providers should consider surveillance of these patients for the development of abnormal renal imaging.

PMID: 34162517

5. ESB Clinical Biomechanics Award 2020: Pelvis and hip movement strategies discriminate typical and pathological femoral growth - Insights gained from a multi-scale mechanobiological modelling framework
Hans Kainz, Bryce A Killen, Anja Van Campenhout, Kaat Desloovere, Jose Manuel Garcia Aznar, Sandra Shefelbine, Ilse Jonkers

Clin Biomech (Bristol, Avon). 2021 Jun 5;87:105405. doi: 10.1016/j.clinbiomech.2021.105405. Online ahead of print.

Background: Many children with cerebral palsy (CP) develop skeletal deformities during childhood. So far, it is unknown why some children with CP develop bony deformities whereas others do not. The aims of this study were to (i) investigate what loading characteristics lead to typical and pathological femoral growth, and (ii) evaluate why some children with CP develop femoral deformities whereas other do not. Methods: A multi-scale mechanobiological modelling workflow was used to simulate femoral growth based on three-dimensional motion capture data of six typically developing children and 16 children with CP. Based on the growth results, the participants with CP were divided into two groups: typical growth group and pathological growth group. Gait kinematics and femoral loading were compared between simulations resulting in typical growth and those resulting in pathologic growth. Findings: Hip joint contact forces were less posteriorly-oriented in the pathological growth simulations compared to the typical ones. Compared to the typically developing participants, the CP group with pathological femoral growth presented increased knee flexion and no hip extension. The CP group with simulated typical growth presented similar sagittal plane joint kinematics but differed in the frontal plane pelvic and hip movement strategy, which normalized the hip joint contact force and therefore contributed to typical femoral growth trends. Interpretation: Our simulation results identified specific gait features, which may contribute to pathological femoral growth. Furthermore, the hip joint contact force orientation in the sagittal plane seems to be the dominant factor for determining femoral growth simulations.

PMID: 34161909

6. Changes in intersegmental stability during gait in patients with spastic cerebral palsy
Junkyung Song, Narae Shin, Kitae Kim, Jaebum Park

Gait Posture. 2021 Jun 11;88:264-271. doi: 10.1016/j.gaitpost.2021.06.002. Online ahead of print.

Background: Dysfunction in peripheral and neural structure with spastic cerebral palsy (CP) causes impaired performance and stability of various behaviors. Recent progress of quantification methods for the stability properties, which is based on the uncontrolled manifold hypothesis, has been applied to various neurological disorders. A prior study revealed that the ability for purposeful regulation of stability properties is weakened with CP during finger and hand actions. Successive regulation of stability properties is crucial for human locomotion; therefore, it is imperative to quantify the changes in the intersegmental coordination as to the stable performance in CP individuals during gait. Research question: We hypothesized that (1) Spastic CP group will show smaller step length and gait velocity with larger variability, and (2) Spastic CP group will show no changes in average stability indices for both the COM and head position stabilization, while the smaller difference between stable and unstable posture during the gait cycle. Methods: Whole-body kinematic data during walking were collected from CP and control subjects. Step length, velocity, and coefficient of variation (CV) were calculated as spatiotemporal parameters. We quantified the intersegmental stability index in time-series during gait for the stabilization of the whole-body COM and head position. Results: The CP subjects showed smaller step length and velocity with larger CV than the controls. However, the CP group showed a significantly less difference in the stability indices between the single- and double-limb support phases as compared to the controls for both the COM and head position stabilization. Significance: Present study is the first to document the quantification of changing intersegmental stability in the spastic CP during locomotion. The dysfunction of intentional modulation of stability properties in CP individuals may be a more common problem, which is not limited to a specific body effector.

PMID: 34144330

7. Early Development of Locomotor Patterns and Motor Control in Very Young Children at High Risk of Cerebral Palsy, a Longitudinal Case Series
Annike Bekius, Margit M Bach, Laura A van de Pol, Jaap Harlaar, Andreas Daffertshofer, Nadia Dominici, Annemieke I Buizer

Case Reports Front Hum Neurosci. 2021 Jun 3;15:659415. doi: 10.3389/fnhum.2021.659415. eCollection 2021.

The first years of life might be critical for encouraging independent walking in children with cerebral palsy (CP). We sought to identify mechanisms that may underlie the impaired development of walking in three young children with early brain lesions, at high risk of CP, via comprehensive instrumented longitudinal assessments of locomotor patterns and muscle activation during walking. We followed three children (P1-P3) with early brain lesions, at high risk of CP, during five consecutive gait

analysis sessions covering a period of 1 to 2 years, starting before the onset of independent walking, and including the session during the first independent steps. In the course of the study, P1 did not develop CP, P2 was diagnosed with unilateral and P3 with bilateral CP. We monitored the early development of locomotor patterns over time via spatiotemporal gait parameters, intersegmental coordination (estimated via principal component analysis), electromyography activity, and muscle synergies (determined from 11 bilateral muscles via nonnegative matrix factorization). P1 and P2 started to walk independently at the corrected age of 14 and 22 months, respectively. In both of them, spatiotemporal gait parameters, intersegmental coordination, muscle activation patterns, and muscle synergy structure changed from supported to independent walking, although to a lesser extent when unilateral CP was diagnosed (P2), especially for the most affected leg. The child with bilateral CP (P3) did not develop independent walking, and all the parameters did not change over time. Our exploratory longitudinal study revealed differences in maturation of locomotor patterns between children with divergent developmental trajectories. We succeeded in identifying mechanisms that may underlie impaired walking development in very young children at high risk of CP. When verified in larger sample sizes, our approach may be considered a means to improve prognosis and to pinpoint possible targets for early intervention.

PMID: 34149378

8. An Accessible Training Device for Children with Cerebral Palsy
Guoqing Wan, Hsieh-Chun Hsieh, Chien-Heng Lin, Hung-Yu Lina, Chien-Yu Linb, Wen-Hsin Chiu

IEEE Trans Neural Syst Rehabil Eng. 2021 Jun 24;PP. doi: 10.1109/TNSRE.2021.3092199. Online ahead of print.

Walking and balance capabilities can be improved upon using repetitive ankle dorsiflexion exercises. Here we developed two types of pedal switches incorporated with training devices to improve their walking and balance performance of children with cerebral palsy. The first type of pedal switch can be used to operate a home appliance, while the second type of pedal switch can connect them to web games. Pedal switches can be used for home rehabilitation. This randomized controlled trial included patients in the intervention (n = 24) and control (n = 24) groups who completed 15 weeks of ankle training. The experimental group performed ankle dorsiflexion using a pressure-activated pedal switch connected to the web games. The control group performed ankle dorsiflexion exercises using a pedal switch that operated a home appliance (a fan). Standing balance and walking performance were estimated using the Zebris FDM system, a pressure force platform, the Pediatric Balance Scale score, and the 1-minute walk test. The pre-and posttest data were analyzed using analysis of variance and analysis of covariance, which revealed that the intervention group had more significant improvements in sway patterns and balance and walking. The developed facility of a modified pedal switch integrated with web games can achieve better exercise adherence to promote balance and walking performance than that with home appliances. Maintaining motivation in children with cerebral palsy plays a very important role in the rehabilitation process.

PMID: 34166195

9. [Effectiveness of treadmill training on the motor development of children with cerebral palsy and Down syndrome] [Article in Spanish]
Silvia Garcia-Del Pino-Ramos, Rita P Romero-Galisteo, Elena Pinero-Pinto, Cristina Lirio-Romero, Rocío Palomo-Carrión

Medicina (B Aires). 2021;81(3):367-374.

Cerebral palsy and Down syndrome are two conditions that present with a deficit in motor development. Treadmill interventions were found to improve this delay in development. This work aimed to describe and analyze the methodological quality of studies that applied treadmill interventions alone or combined with other therapies to promote gait and balance in children under 12 years of age with cerebral palsy and Down syndrome. A systematic review was made in different databases: PubMed, PEDro, Cochrane and Science Direct. Only randomized clinical trials published to date were selected. The methodological quality of the identified studies was assessed using the PEDro scale. Of the 324 articles initially found, 10 were selected, which met the established inclusion criteria for qualitative analysis. The variables analyzed were gait and balance in both populations after the treadmill intervention, with and without suspension of body weight. The main conclusion was that the application of a treadmill alone is an effective intervention to promote the development of gait and balance in children under 12 years with cerebral palsy and Down syndrome.

PMID: 34137695

10. Effect of Community-Based Functional Aerobic Training on Motor Performance and Quality of Life of Children with Spastic Cerebral Palsy
Osei Evans Owusu Ansa, Kwadwo Wisdom Mprah, Monday Omoniyi Moses, Isaac Owusu, Enoch Acheampong

Ethiop J Health Sci. 2021 Mar;31(2):381-392. doi: 10.4314/ejhs.v31i2.21.

Background: Efficacies of community-based exercise programmes have been well reported, but there is scarce information on the expediency of community-based rehabilitation in a society where many children with disabilities live in poorly resourced settings with extremely limited rehabilitative services. This study investigated the effects of community-based functional aerobic exercise (CBFAE) on gross motor function, walking distance, and quality of life of children with cerebral palsy (CP). Methods: Quasi-experimental design was used. Children with gross motor function classification system (GMFCS) levels I - II participated in eight weeks CBFAE training four times/week, 50 minutes/day at 40-80% maximum heart rate. Gross motor function (GMF), walking distance and quality of life were assessed pre and post CBFAE training. Results: Significant improvement was observed in GMF (Dstanding) (8.2%, P=.000), GMF (E-walking + running+ jumping (5.12%, P=.004), walking distance (6.09%, P=.009). Higher significant positive effects of CBFAE were observed in Social wellbeing and acceptance (107.10%, P=.000), and participation and physical health (105.04%, P=.005) by children parent proxy. Self-reported results showed that for CBFAE, significant positive improvements were higher in pain and impact of disability (67.93%, P=.049) and participation and physical health (60.00%, P=.042). Conclusion: CBFAE training contributes majorly to improved standing, walking, jumping and running and self-esteem, quality of life of children with spastic CP. Clinicians and exercise therapists should essentially incorporate CBFAE training and activities into the management of children with CP for improved mobility and functional performances.

PMID: 34158790

11. Exploring the use of Halliwick aquatic therapy in the rehabilitation of children with disabilities: a scoping review
Stephanie Rohn, Monika Novak Pavlic, Peter Rosenbaum

Review Child Care Health Dev. 2021 Jun 21. doi: 10.1111/cch.12887. Online ahead of print.

Introduction: Halliwick aquatic therapy is a rehabilitation intervention that is gaining popularity for people with disabilities. This scoping review provides an overview on the state of research about the impact of Halliwick aquatic therapy for children with disabilities. Methods: Four electronic databases were searched to obtain research on the use of the Halliwick method for pediatric rehabilitation: Medline, CINAHL, Embase and PsycINFO. Potential citations were first screened by title and abstract, and full texts were then examined on the second round of screening. We analyzed the demographic details of their study population, how therapy was implemented (e.g. lesson frequency or structure), and what measurements were used, with measured variables mapped onto the domains of the framework for health of the WHO's International Classification of Functioning, Disability and Health (ICF). Results: Twenty-four publications met the inclusion criteria for this review. The majority of research included children with cerebral palsy (n=12) or autism spectrum disorder (n=8), with very few studies including other disabilities (n=5). There was a wide variation in the number of lessons per study and how each lesson was structured. Fourteen studies lacked a control group. Looking at ICF domains, all 24 articles measured variables pertaining to body structure and functions, four looked for changes in performance of daily activities, four into ability to participate in social roles, and seven into changes in personal factors. Conclusion: There is no consensus on how the Halliwick method should be structured for participants, leaving a gap for future research on program implementation. To shift our viewpoint beyond what a disability prevents to what one's level of health and functioning allows, it is important to broaden the scope of research into the other ICF domains.

PMID: 34155683

12. Videofluoroscopic Swallow Study Findings and Correlations in Infancy of Children with Cerebral Palsy
Amit Narawane, Christina Rappazzo, Jean Hawney, James Eng, Julina Ongkasuwan

Ann Otol Rhinol Laryngol. 2021 Jun 21;34894211026741. doi: 10.1177/00034894211026741. Online ahead of print.

Objectives: Cerebral palsy (CP) in infants can affect global motor function and lead to swallowing difficulties. This study aims

to characterize oral and pharyngeal swallowing dynamics in infancy of patients later diagnosed with CP and to determine if swallow study performance in early infancy is associated with later CP severity and characteristics. Methods: This is a retrospective chart review of infants who underwent videofluoroscopic swallow studies (VFSS) between 6/2008 and 10/2018 at a tertiary children's hospital, and were later diagnosed with CP. Demographic data, CP characteristics and metrics, and VFSS findings were collected and analyzed. Results: There were 66 patients included in this study. The average age at the time of VFSS was 4 months (range: 0.3-12 months), 42% of patients were female, and 50% of patients were born premature. In our sample, 86% of patients presented with oral dysphagia, and 76% with pharyngeal dysphagia. Laryngeal penetration in isolation was seen in 39% of patients, and tracheal aspiration was seen in 38% of patients. Of these tracheal aspiration events, 64% were silent. At the time of VFSS, 58% of patients had a nasogastric tube, 12% had a gastrostomy tube, and 3% had a prior hospitalization for pneumonia. Rates of penetration and aspiration in early infancy did not consistently correlate with prematurity, type of CP (spastic, non-spastic, or mixed), degree of paralysis (quadriplegic, hemiplegic, or diplegic), or severity of Gross Motor Function Classification System (GMFCS) score. Conclusion: While there was not a consistent correlation of swallowing dynamics in infancy with later gross motor categorizations of CP, the results of this retrospective review highlight the essential role of early clinical and videofluoroscopic swallowing evaluations to identify oral and pharyngeal swallowing dysfunction in this patient population.

PMID: 34148427

13. Caregiver perspectives of managing chronic pain in children and adolescents with dyskinetic and mixed dyskinetic/ spastic CP with communication limitations
Clare McKinnon, Jenni White, Adrienne Harvey, Giuliana Antolovich, Prue Morgan

J Pediatr Rehabil Med. 2021 Jun 13. doi: 10.3233/PRM-200770. Online ahead of print.

Purpose: Caregivers provide unique insights into managing chronic pain in children and adolescents with dyskinetic and mixed dyskinetic/spastic cerebral palsy with communication limitations. This study explored the personal challenges caregivers face in supporting their child's everyday pain management, including barriers and facilitators to effective chronic pain management. Methods: Semi-structured interviews were undertaken with ten caregivers (all mothers) of children with either dyskinetic or mixed dyskinetic/spastic cerebral palsy. All children had chronic pain (> 3 months), were aged from 5 to 15 years, had significant functional limitations, and had either limited or no capacity to self-report their pain. Interpretative phenomenological analysis was used to explore caregivers' subjective experiences of managing their child's chronic pain within family, school, and healthcare contexts. Results: Five superordinate themes emerged: 1. the continual challenge of problem solving pain and dyskinesia; 2. the pursuit of a solution; 3. unfulfilled preferences within pain management; 4. all-encompassing effects on families; and 5. the ongoing impacts of pain and dyskinesia with age. Conclusion: There is a need for structured pain education and resources targeted towards caregivers and support workers that account for the complex overlay of dyskinesia. There is a further need to ensure caregiver preferences for nonpharmacological pain treatments are met within family-centred care models.

PMID: 34151872

14. The Effect of Video-Based Games on Hand Functions and Cognitive Functions in Cerebral Palsy
Yasin Yildirim, Miray Budak, Devrim Tarakci, Zeliha Candan Algun

Games Health J. 2021 Jun;10(3):180-189. doi: 10.1089/g4h.2020.0182.

Objective: The purpose of this study is to investigate the effect of Leap Motion Based Exergame Therapy (LMBET) on upper limb gross grip strength (GGS), pinch forces, hand functions, gross motor function, and cognitive functions in patients with cerebral palsy (CP). Materials and Methods: Twenty patients with CP (11 hemiplegia and 9 diplegia) were included in the study. Structured Neurodevelopmental Therapy-based hand rehabilitation (SNDTBHR) (first treatment period) was applied a total of 12 sessions, 2 sessions per week (total 6 weeks), and then LMBET (second treatment period) was applied a total of 12 sessions, 2 sessions per week (total 6 weeks). GGS was evaluated by "dynamometer," pinch strengths were evaluated by "pinch meter," hand skills were evaluated by "Manual Ability Classification System (MACS)" and "Jebsen-Taylor Hand Function Test (JHFT)," the gross motor level was evaluated by "Gross Motor Function Classification System (GMFCS)," and cognitive functions were evaluated by "Wisconsin Card Sorting Test (WCST)." Results: Significant difference was found between LMBET and SNDTBHR on GGF, pinch forces, JHFT, and WCST in favor of LMBET ($P < 0.017$). There was no significant difference between both MACS and GMFCS measurements ($P > 0.05$). Conclusion: Positive effects of both SNDTBHR and LMBET have been found. However, measurements after LMBET are statistically more significant. Future research should take

into account higher patient allocation. Including additional leap motion training to conventional physiotherapy is feasible and might be promising to train cognitive function in children with CP.

PMID: 34143667

15. Cerebral Palsy in Very Preterm Infants: A Nine-Year Prospective Study in a French Population-Based Tertiary Center

Clément Chollat, Emmanuelle Bertrand, Alice Petit-Ledo, Caroline de Vansay, Caroline Voisin, Ivana Dabaj, André Gillibert, Stéphane Marret, Perinatal Network of Upper Normandy

J Pediatr. 2021 Jun 15;S0022-3476(21)00539-4. doi: 10.1016/j.jpeds.2021.06.018. Online ahead of print.

Objectives: To describe the prevalence of cerebral palsy (CP) at age 2 years in infants born before 33 weeks of gestation and to analyze the fetal neuroprotective effect of the antenatal administration of magnesium sulfate treatment on CP. Study design: Preterm infants born before 33 weeks of gestation and discharged from the Rouen University Hospital Neonatal Intensive Care Unit (NICU) between 2007 and 2015 were included. At age 2 years, pediatricians of the perinatal network of the Eure and the Seine-Maritime counties administered standardized questionnaires analyzing motor, cognitive, and behavioral items, derived from the Denver and Amiel-Tison scales. A routine protocol based on magnesium sulfate infusion was introduced in 2010. The primary outcome measure was the occurrence of CP according to the Surveillance of Cerebral Palsy in Europe (SCPE) network definition. Results: A total of 1759 very preterm infants were included, among whom 138 (7.8%) died and 148 (9.1%) were lost to follow-up. Assuming lost to follow-up had no CP, at two years, 55/1621 (3.4%, 95% CI: 2.6 to 4.4%) infants had CP. After statistical adjustment for birth term and antenatal corticosteroid usage, a significant decrease of CP was observed after implementation of a protocol of MgSO4 administration in mothers before imminent preterm birth at less than 33 weeks of gestation (adjusted odds ratio 0.53, 95% CI: 0.29 to 0.98, P = .04). Conclusions: The prevalence of CP at two years after very preterm birth was low. The implementation of a magnesium sulfate neuroprotective protocol was associated with reduction of CP occurrence; however, several relevant limitations must be considered for interpretation.

PMID: 34144033

16. [Effect of rehabilitation treatment based on the ICF-CY Core Sets on activities of daily living in children with cerebral palsy: a prospective randomized controlled study][Article in Chinese]

Lei Yang, San-Song Li, Guang-Yu Zhang, Ming-Mei Wang, Gong-Xun Chen, Deng-Na Zhu

Randomized Controlled Trial Zhongguo Dang Dai Er Ke Za Zhi. 2021 Jun;23(6):608-612. doi: 10.7499/j.issn.1008-8830.2103060.

Objective: To study the effect of rehabilitation treatment based on the International Classification of Functioning, Disability and Health-Children and Youth Version (ICF-CY) Core Sets on activities of daily living in children with cerebral palsy. Methods: The children with cerebral palsy were divided into an observation group (n=63) and a control group (n=59) using a random number table. The children in the observation group were evaluated using the brief ICF-CY Core Sets for children under 6 years to identify intervention targets and develop rehabilitation plans and goals, and then specific methods were selected for rehabilitation treatment. The children in the control group were evaluated and treated with the traditional rehabilitation mode. The scores of the Functional Independence Measure for Children (WeeFIM) and the Infants-Junior Middle School Students' Social-Life Abilities Scale were assessed for both groups before treatment and after three courses of treatment. The intervention of environmental factors was compared between the two groups. Results: There was no significant difference in the scores of the WeeFIM and Social-Life Abilities scales between the two groups before treatment ($P > 0.05$). After treatment, both groups had significant increases in the scores of the WeeFIM and Social-Life Abilities scales ($P < 0.001$). The observation group had significantly higher scores of WeeFIM and Social-Life Abilities scales than the control group after treatment ($P < 0.05$). There was no significant difference in the use rate of orthosis between the two groups ($P > 0.05$), but the use rate of assistive devices for self-help, transfer and communication, the rate of facility renovation, and the rate of family rehabilitation guidance in the observation group were significantly higher than those in the control group ($P < 0.05$). Conclusions: The rehabilitation treatment regimen for cerebral palsy based on the CF-CY Core Sets pays more attention to the influence of environmental factors in the process of rehabilitation and can effectively improve the activities of daily living of children with cerebral palsy.

PMID: 34130783

17. Associations between tactile localization and motor function in children with motor deficits
Daiki Asano, Shu Morioka

Int J Dev Disabil. 2017 Jan 12;64(2):113-119. doi: 10.1080/20473869.2016.1278316.

Children with developmental disorders often have poor motor performance. This study aimed to address the association between tactile localization ability, an indicator of body image, and motor function in children with motor deficits. Eighteen children with motor deficits participated, and their upper and lower limbs were assessed. To assess the level to which the patient's body image was developed, a tactile localization task (TLT) was used. In the TLT, experimenters touched a child's fingers, toes, or lower extremities (L/E), and the participants were asked to identify the location of the touch on a body part illustration. We compared TLT ability between high and low motor function groups, and investigated the correlation between TLT and the measures of motor function, age, and non-verbal intelligence. The high motor function group had significantly higher L/E TLT scores than the low motor function group, except in the tests involving the fingers and toes. Furthermore, the L/E TLT correlated only with motor function measures (Gross Motor Function Measure score, measured using one-leg standing time and one-leg hopping ability). The results suggest that children with motor deficits experience developmental delay in terms of their body image.

PMID: 34141298

18. Somatosensory deficits and neural correlates in cerebral palsy: a scoping review
Clémentine Brun, Élodie Traverse, Élyse Granger, Catherine Mercier

Review Dev Med Child Neurol. 2021 Jun 17. doi: 10.1111/dmcn.14963. Online ahead of print.

Aim: To synthetize studies assessing somatosensory deficits and alterations in cerebral responses evoked by somatosensory stimulation in individuals with cerebral palsy (CP) compared to typically developing individuals. Method: A scoping review of the literature was performed in the MEDLINE, Embase, PsycInfo, CINAHL, Evidence-Based Medicine Reviews, and Web of Science databases (last search carried out on 6th and 7th August 2020) with a combination of keywords related to CP and somatosensory functions. Somatosensory deficits were measured with clinical tests and alterations in cerebral responses were measured with functional magnetic resonance imaging, electroencephalography, and magnetoencephalography. Results: Forty-eight articles were included. Overall, 1463 participants with CP (mean [SD] age 13y 1mo [4y 11mo], range 1-55y; 416 males, 319 females, sex not identified for the remaining participants) and 1478 controls (mean [SD] age 13y 1mo [5y 8mo], range 1-42y; 362 males, 334 females, sex not identified for the remaining participants) were included in the scoping review. For tactile function, most studies reported registration (8 out of 13) or perception (21 out of 21) deficits in participants with CP. For proprioception, most studies also reported registration (6 out of 8) or perception (10 out of 15) deficits. Pain function has not been studied as much, but most studies reported registration (2 out of 3) or perception (3 out of 3) alterations. Neuroimaging findings (18 studies) showed alterations in the somatotopy, morphology, latency, or amplitude of cortical responses evoked by somatosensory stimuli. Interpretation: Despite the heterogeneity in the methods employed, most studies reported somatosensory deficits. The focus has been mainly on tactile and proprioceptive function, whereas pain has received little attention. Future research should rigorously define the methods employed and include a sample that is more representative of the population with CP.

PMID: 34145582

19. Successfully Negotiating Life Challenges: Learnings From Adults With Cerebral Palsy
Cadeyrn J Gaskin, Christine Imms, Gavin R Dagley, Michael E Msall, Dinah Reddihough

Qual Health Res. 2021 Jun 24;10497323211023449. doi: 10.1177/10497323211023449. Online ahead of print.

Despite facing multidimensional inequalities, some adults with cerebral palsy achieve positive social outcomes (e.g.,

independent living, employment, and romantic relationships). We interviewed 23 adults (aged 23-47 years) about how they successfully negotiated the challenges of adulthood. Common to all life situations was doing what others (people without cerebral palsy) do. Origins of success lay in their formative experiences (e.g., typical parental expectations with commensurate support and acceptance and supported involvement in school life). Their present functioning (e.g., positive self-concept, well-honed social skills, and physical fitness) combined with present contexts (e.g., expectations of involvement in adult activities and accessible and accommodating environments) enabled them to find ways of negotiating challenges. Finding a way included drawing on knowledge and skills, gravitating toward those who are comfortable with difference, maintaining function, and using natural and paid supports. The findings suggest multiple avenues for supporting people with cerebral palsy to achieve positive social outcomes.

PMID: 34166133

20. Caregiver burden versus intensity of anxiety and depression symptoms in parents of children with cerebral palsy as well as factors potentially differentiating the level of burden: a cross-sectional study (Poland)
Barbara Gugała

BMJ Open. 2021 Jun 18;11(6):e036494. doi: 10.1136/bmjopen-2019-036494.

Objectives: To assess the relationship between caregiver burden and severity of symptoms of anxiety/depression in parents of children with cerebral palsy (CP), and to identify factors differentiating the level of caregiver burden. Setting: Regional rehabilitation centres in South-Eastern Poland. Participants: The study involved 190 parents of children with CP, that is, 138 women and 52 men. Primary and secondary outcome measures: Caregiver burden was assessed using Caregiver Burden Scale (CBS), while the intensity of anxiety and depression symptoms was measured using Hospital Anxiety and Depression Scale (HADS). Potential predictors were examined using Gross Motor Function Classification System for Cerebral Palsy (GMFCS), Barthel Index (BI) as well as a questionnaire focusing on the characteristics of the child, the parent and the family. The analyses applied Pearson's linear correlation coefficient as well as multiple regression analysis. Results: All the CBS measures are significantly correlated to HADS-A (anxiety) and HADS-D (depression). Intensity of anxiety is most visibly linked to CBS measures of disappointment and environment ($p<0.0001$), while severity of depression is related to emotional involvement and general strain ($p<0.0001$). The factors differentiating caregiver burden measure in the subscales of general strain ($p<0.0001$) and social isolation ($p<0.0001$) include the child's age and BI, and the parent's health status; in the subscale of disappointment ($p<0.0001$)-the child's age, BI, GMFCS, as well as the parent's age and health status; in the subscale of emotional involvement ($p=0.0007$)-BI, and the parent's health status; in the subscale of environment ($p=0.0002$)-the child's age and BI. Conclusions: There is a positive linear relationship between the caregiver burden measures and severity of anxiety and depression. Effort should be made to relieve caregiver burden in parents of children with CP.

PMID: 34145003

21. Apgar Score and Risk of Cerebral Palsy in Preterm Infants: A Population-Based Cohort Study
Damjan Osredkar, Ivan Verdenik, Anja Troha Gergeli, Ksenija Gersak, Miha Lucovnik

Neuropediatrics. 2021 Jun 23. doi: 10.1055/s-0041-1729181. Online ahead of print.

A low Apgar score is associated with increased risk of cerebral palsy (CP) in term infants, while such association remains controversial in preterm neonates. The objective of this study was to assess association between 5-minute Apgar scores and CP in different subcategories of preterm birth based on gestational age. The Slovenian National Perinatal Information System was used to identify singleton children without congenital malformations live-born at 22 to 37 weeks of gestation between 2002 and 2010. Data were linked to the Slovenian Registry of Cerebral Palsy in children born between 2002 and 2010. CP was diagnosed at a minimum of 5 years of age. Of 11,924 children included, 241 (2.0%) died before discharge and 153 (1.3%) were diagnosed with CP. Five-minute Apgar scores <7 were significantly associated with higher risk of death or CP (compared with scores ≥9) at all preterm gestations. CP alone was associated with Apgar scores <7 only at moderately or late preterm gestation (32-36 weeks) (adjusted relative risk [aRR]: 8.27; 95% confidence interval [CI]: 1.87-36.64 for scores 0-4 and aRR: 4.96; 95% CI 1.89 -13.06 for scores 5-6). In conclusion, a low 5-minute Apgar score was associated with combined outcome of neonatal death or CP in all preterm births, while in surviving preterm infants at >32 weeks a low 5-minute Apgar score was associated with CP.

PMID: 34162009

22. Post-haemorrhagic hydrocephalus is associated with poorer surgical and neurodevelopmental sequelae than other causes of infant hydrocephalus
Malak Mohamed, Saniya Mediratta, Aswin Chari, Cristine Sortica da Costa, Greg James, William Dawes, Kristian Aquilina

Childs Nerv Syst. 2021 Jun 19. doi: 10.1007/s00381-021-05226-4. Online ahead of print.

Purpose: This retrospective cohort study aimed to investigate the surgical and neurodevelopmental outcomes (NDO) of infant hydrocephalus. We also sought to determine whether these outcomes are disproportionately poorer in post-haemorrhagic hydrocephalus (PHH) compared to other causes of infant hydrocephalus. Methods: A review of all infants with hydrocephalus who had ventriculoperitoneal (VP) shunts inserted at Great Ormond Street Hospital (GOSH) from 2008 to 2018 was performed. Demographic, surgical, neurodevelopmental, and other clinical data extracted from electronic patient notes were analysed by aetiology. Shunt survival, NDO, cerebral palsy (CP), epilepsy, speech delay, education, behavioural disorders, endocrine dysfunction, and mortality were evaluated. Results: A total of 323 infants with median gestational age of 37.0 (23.29 -42.14) weeks and birthweight of 2640 g (525-4684 g) were evaluated. PHH was the most common aetiology (31.9%) and was associated with significantly higher 5-year shunt revision rates, revisions beyond a year, and median number of revisions than congenital or "other" hydrocephalus (all $p < 0.02$). Cox regression demonstrated poorest shunt survival in PHH, related to gestational age at birth and corrected age at shunt insertion. PHH also had the highest rate of severe disabilities, increasing with age to 65.0% at 10 years, as well as the highest CP rate; only genetic hydrocephalus had significantly higher endocrine dysfunction ($p = 0.01$) and mortality rates ($p = 0.04$). Conclusions: Infants with PHH have poorer surgical and NDO compared to all other aetiologies, except genetic hydrocephalus. Research into measures of reducing neurodisability following PHH is urgently required. Long-term follow-up is essential to optimise support and outcomes.

PMID: 34148130

23. Skincare practices in extremely premature infants: A survey of tertiary neonatal intensive care units from Australia and New Zealand
Umesh Mishra, Pranav Jani, Rajesh Maheshwari, Dharmesh Shah, Daphne D'Cruz, Archana Priyadarshi, Claire Galea, Krista Lowe, James Marceau, Audrey Wright

J Paediatr Child Health. 2021 Jun 18. doi: 10.1111/jpc.15578. Online ahead of print.

Aim: To investigate skincare practices in the first 2 weeks of life in extremely premature infants across tertiary neonatal intensive care units (NICUs). Methods: A web-based secure survey invite was emailed to the medical directors of tertiary NICUs. The survey included questions on various aspects of skincare practices in the first 2 weeks of life in extremely premature infants (born before 28 weeks gestation). The person most familiar with local skincare practices was asked to complete the survey and only one response per unit was requested. We performed a descriptive analysis. Results: We received responses from 30 out of 32 NICUs (response rate 93%). Twenty-five NICUs (89%) reported offering resuscitation and intensive care to infants born at ≥23 weeks gestation. All NICUs reported occurrences of skin breakdown, including medical adhesive-related skin injury (30%), abrasion/friction-associated skin injury (46%), perineal skin breakdown (55%), pressure site injury (47%) and diaper dermatitis (60%). A high level of consensus (≥75%) was observed for certain practices, such as the use of polyethylene occlusive plastic wraps at birth and aqueous chlorhexidine solution for sterile procedures, but a low level of consensus (<25%) was observed for many other practices, including the skin risk assessment tool used. Conclusions: Skin injuries in extremely premature infants are common and skincare practices vary considerably amongst NICUs. Clinical practice improvement projects and further clinical research will help improve consistency amongst NICUs. Further research is needed to assist the development of evidence-based guidelines and benchmarking for skincare practices in these vulnerable infants.

PMID: 34145664

24. Children with neonatal Hypoxic Ischemic Encephalopathy (HIE) treated with therapeutic hypothermia are not as school ready as their peers
Caroline J Edmonds, Rina Cianfaglione, Christine Cornforth, Brigitte Vollmer

Acta Paediatr. 2021 Jun 23. doi: 10.1111/apa.16002. Online ahead of print.

Aim: We aimed to determine whether children with neonatal hypoxic-ischaemic encephalopathy (HIE) treated with therapeutic hypothermia (TH) differ from their peers on measures of fine motor skills, executive function, language and general cognitive abilities; factors that are important for school readiness. Methods: We compared school readiness in 31 children with HIE treated with TH (without Cerebral Palsy; mean age 5 years 4 months) with 20 typically developing children without HIE (mean age 5 years 6 months). Results: Children with HIE scored significantly lower than typically developing children on fine motor skills, executive functions, memory and language. Conclusion: While general cognitive abilities and attainment were in the normal range, our findings suggest those scores mask specific underlying difficulties identified by more focussed assessments. Children with HIE treated with TH may not be as "school ready" as their typically developing classmates and may benefit from long-term follow-up until starting school.

PMID: 34160861

25. Reflections from Conference Convenor Professor Iona Novak and Scientific Committee Chair Professor Stacey George
Iona Novak, Stacey George

Editorial Aust Occup Ther J. 2021 Jun;68 Suppl 1:6. doi: 10.1111/1440-1630.12749.

PMID: 34157143

26. The Dyskinetic Cerebral Palsy Functional Impact Scale: development and validation of a new tool
Kirsty Stewart, Jennifer Lewis, Margaret Wallen, Natasha Bear, Adrienne Harvey

Dev Med Child Neurol. 2021 Jun 19. doi: 10.1111/dmcn.14960. Online ahead of print.

Aim: To outline the development and examine the content and construct validity of a new tool, the Dyskinetic Cerebral Palsy Functional Impact Scale (D-FIS), which measures the impact of dyskinesia on everyday activities in children with cerebral palsy (CP). Method: D-FIS content was informed by a systematic review of dyskinesia outcome measures, in collaboration with children with dyskinetic CP, parents, caregivers, and expert clinicians. The D-FIS uses parent proxy to rate impact of dyskinesia on everyday activities. Construct validity was determined by examining internal consistency; known groups validity with the Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS), Communication Function Classification System (CFCS), and Eating and Drinking Ability Classification System (EDACS); and convergent validity with the Barry-Albright Dystonia Scale (BADS). Results: Fifty-seven parents of children (29 males, 28 females, mean [SD] age 11y 8mo [4y 4mo], range 2y 6mo-18y) completed the D-FIS. Correlation between D-FIS and GMFCS was r=0.86 (95% confidence interval [CI]: 0.77-0.91, p<0.001); MACS r=0.84 (95% CI: 0.73-0.90, p<0.001); CFCS r=0.80 (95% CI: 0.67-0.88, p<0.001); and EDACS r=0.78 (95% CI: 0.66-0.87). Correlation between D-FIS and BADS was r=0.77 (95% CI: 0.64-0.86, p<0.001). Cronbach's alpha was 0.96. Interpretation: The D-FIS demonstrates good construct validity and high internal consistency. The D-FIS will be useful for identifying priorities for intervention. It adds to the measurement tool kit for children with dyskinetic CP by addressing functional impact of dyskinetic movements and postures.

PMID: 34145577

27. Translation with Cross-cultural Adaptation of Cerebral Palsy Quality of Life Questionnaire for Children into Nepali and its Psychometric Properties
N Shrestha, A Suwal, S Kc, S P Adhikari

Kathmandu Univ Med J (KUMJ). 2020 Jul-Sept.;18(71):249-255.

Background: Cerebral Palsy Quality of Life questionnaire for children primary caregiver version is the widely used condition specific outcome measure which assesses the wellbeing of the child. It has been translated to many languages and shows excellent psychometric properties. Availability in Nepali would facilitate the use in clinical practice and research in Nepali population. Objective: The objective of this study was translation with cross-culturally adaption of Cerebral Palsy Quality of

Life questionnaire for children primary caregiver version into Nepali and assess its psychometric properties. Method: Cross-cultural adaptation was performed using forward and backward translation protocol. Pretesting was done on six participants to confirm that the original concept was preserved. The Nepali version of questionnaire was administered twice for data collection. The feasibility, sensitivity, internal consistency and test-retest reliability was determined. Result: Culturally adapted Nepali version showed good feasibility only the domain "Access to service" had a highest missing score related to use of the special equipment, attending kindergarten and applying for respite care. Floor and ceiling effect were < 15% in all the domains except in few items of "Pain and impact of disability" and "Social well being and acceptance". Test retest reliability (0.82 - 0.91) and internal consistency (0.68 - 0.84) was good. There were weak association of domains with the gross motor functional classification system level. Conclusion: Cross-culturally adapted Nepali Cerebral Palsy Quality of Life questionnaire for children primary caregiver was developed. It demonstrates good psychometric properties confirming to assess quality of life of children with Cerebral palsy in Nepal.

PMID: 34158431

28. Commentary on "Parent-Reported PEDI-CAT Mobility and Gross Motor Function in Infants With Cerebral Palsy"
Barbara Sargent, Loretta Staudt, Lindsey Garg

Pediatr Phys Ther. 2021 Jul 1;33(3):162. doi: 10.1097/PEP.0000000000000809.

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