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. An automated framework for pediatric hip surveillance and severity assessment using radiographs

Van Khanh Lam, Elizabeth Fischer, Kochai Jawad, Sean Tabaie, Kevin Cleary, Syed Muhammad Anwar

Purpose: Hip dysplasia is the second most common orthopedic condition in children with cerebral palsy (CP) and may result in disability and pain. The migration percentage (MP) is a widely used metric in hip surveillance, calculated based on an anterior-posterior pelvis radiograph. However, manual quantification of MP values using hip X-ray scans in current standard practice has challenges including being time-intensive, requiring expert knowledge, and not considering human bias. The purpose of this study is to develop a machine learning algorithm to automatically quantify MP values using a hip X-ray scan, and hence provide an assessment for severity, which then can be used for surveillance, treatment planning, and management. Methods: X-ray scans from 210 patients were curated, pre-processed, and manually annotated at our clinical center. Several machine learning models were trained using pre-trained weights from Inception ResNet-V2, VGG-16, and VGG-19, with different strategies (pre-processing, with and without region of interest (ROI) detection, with and without data augmentation) to find an optimal model for automatic hip landmarking. The predicted landmarks were then used by our geometric algorithm to quantify the MP value for the input hip X-ray scan. Results: The pre-trained VGG-19 model, fine-tuned with additional custom layers, outputted the lowest mean squared error values for both train and test data, when ROI cropped images were used along with data augmentation for model training. The MP value calculated by the algorithm was compared to manual ground truth labels from our orthopedic fellows using the hip screen application for benchmarking. Conclusion: The results showed the feasibility of the machine learning model in automatic hip landmark detection for reliably quantifying MP value from hip X-ray scans. The algorithm could be used as an accurate and reliable tool in orthopedic care for diagnosing, severity assessment, and hence treatment and surgical planning for hip displacement.

PMID: 39283409

2. Optimal configurations of an electromagnetic tracking system for 3D ultrasound imaging of pediatric hips - A phantom study

Thanh-Tu Pham, Lawrence H Le, John Andersen, Edmond H Lou

Tracking the position and orientation of a two-dimensional (2D) ultrasound scanner to reconstruct a 3D volume is common, and its accuracy is important. In this study, a specific miniaturized electromagnetic (EM) tracking system was selected and integrated with a 2D ultrasound scanner, which was aimed to capture hip displacement in children with cerebral palsy. The objective of this study was to determine the optimum configuration, including the distance between the EM source and sensor, to provide maximum accuracy. The scanning volume was aimed to be 320 mm × 320 mm × 76 mm. The accuracy of the EM tracking was evaluated by comparing its tracking with those from a motion capture camera system. A static experiment showed that a warm-up time of 20 min was needed. The EM system provided the highest precision of 0.07 mm and 0.01° when the distance between the EM source and sensor was 0.65 m. Within the testing volume, the maximum position and

rotational errors were 2.31 mm and 1.48°, respectively. The maximum error of measuring hip displacement on the 3D hip phantom study was 4 %. Based on the test results, the tested EM system was suitable for 3D ultrasound imaging of pediatric hips to assess hip displacement when optimal configuration was used.

PMID: 39284650

3. Feasibility and usefulness of video-based markerless two-dimensional automated gait analysis, in providing objective quantification of gait and complementing the evaluation of gait in children with cerebral palsy

Evelina Pantzar-Castilla, Diletta Balta, Ugo Della Croce, Andrea Cereatti, Jacques Riad

Background: Gait analysis aids in evaluation, classification, and follow-up of gait pattern over time in children with cerebral palsy (CP). The analysis of sagittal plane joint kinematics is of special interest to assess flexed knee gait and ankle joint deviations that commonly progress with age and indicate deterioration of gait. Although most children with CP are ambulatory, no objective quantification of gait is currently included in any of the known international follow-up programs. Is video-based 2-dimensional markerless (2D ML) gait analysis with automated processing a feasible and useful tool to quantify deviations, evaluate and classify gait, in children with CP? Methods: Twenty children with bilateral CP with Gross Motor Function Classification Scale (GMFCS) levels I-III, from five regions in Sweden, were included from the national CP registry. A single RGB-Depth video camera, sensitive to depth and contrast, was positioned laterally to a green walkway and background, with four light sources. A previously validated markerless method was employed to estimate sagittal plane hip, knee, ankle kinematics, foot orientation and spatio-temporal parameters including gait speed and step length. Results: Mean age was 10.4 (range 6.8-16.1) years. Eight children were classified as GMFCS level I, eight as II and four as III. Setup of the measurement system took 15 min, acquisition 5-15 min and processing 50 min per child. Using the 2D ML method kinematic deviations from normal could be determined and used to implement the classification of gait pattern, proposed by Rodda et al. 2001. Conclusion: 2D ML assessment is feasible, since it is accessible, easy to perform and well tolerated by the children. The 2D ML adds consistency and quantifies objectively important gait variables. It is both relevant and reasonable to include 2D ML gait assessment in the evaluation of children with CP.

PMID: 39289680

4. Association Between Calf Muscle Tone, Plantar Surface Area, and Gross Motor Function in Children with Spastic Diplegic Cerebral Palsy

Hisham Mohamed Hussein, Amsha Alhumaidi Alshammari, Hand Zamel M Alshammari, Monira I Aldhahi, Yahya Ali Hamad Suwaidi, Ahmed Abdelmoniem Ibrahim

Background: Children diagnosed with spastic diplegic Cerebral Palsy (CP) usually demonstrate hypertonicity of the lower limb muscles which affects the normal alignments and weight reception by the feet. These impairments could be correlated to the limitations in gross motor function such as standing and walking abilities. Understanding these relationships can contribute to developing more effective rehabilitation strategies and improving overall motor outcomes for affected children. Objective: The current study was designed to explore the relationship between plantar surface area, weight distribution on the plantar surface, and gross motor function (namely, standing and walking abilities) in spastic diplegic CP children. Methods: Seventy-one spastic diplegic CP children aged 8-14 years joined this cross-sectional study. The Person's correlation coefficient and regression tests were used to assess the correlation between variables, namely, Gross Motor Function (GMFM), Calf Muscle Tone, Plantar surface area (PSA), and Peak pressure on mid and hind feet (PPMF, PPHF, respectively). These variables were assessed using the GMFM-88 scale, Modified Ashworth scale, and foot scan plantar pressure detection system, respectively. Results: The correlation analysis demonstrated a strong to moderate positive correlation between PSA, PPMF, PPHF, and GMFM-D and GMFM-E. Additionally, regression model showed prediction levels equal to 0.791 for the GMFM-D and 0.720 for the GMFM-E categories, respectively. Conclusion: Standing and walking abilities were positively correlated (r ≥.6) with the increased plantar surface area and higher peak pressure on mid and hind feet in spastic diplegic CP. Future longitudinal studies should investigate changes in gross motor function in relation to improvement in plantar surface area and peak pressure values.

PMID: 39295857

5. Changes in Lower Extremity Passive Range of Motion and Muscle Strength After Selective Percutaneous Myofascial Lengthening and Functional Physiotherapy in Children With Cerebral Palsy

Vasileios C Skoutelis, Zacharias Dimitriadis, Anastasios Kanellopoulos, Argirios Dinopoulos, Panayiotis J Papagelopoulos, Vivian Kanellopoulos, Vasileios A Kontogeorgakos

Background Children with cerebral palsy (CP) often experience motor and postural disorders, along with spasticity, muscle weakness, muscle-tendon contractures, and decreased joint range of motion (ROM). Muscle-tendon contractures are typically addressed through orthopaedic surgery to improve joint ROM, which can result in further muscle weakness. This study aimed to investigate the impact of selective percutaneous myofascial lengthening (SPML) combined with functional physiotherapy on joint passive ROM and isometric muscle strength in the lower extremities of children with spastic CP. Methods A single-group pre- and post-test design was utilised in this study. Twenty-six children aged five to seven years with spastic CP and Gross Motor Function Classification System levels II-IV underwent the SPML procedure and received nine months of postoperative functional strength training physiotherapy. Joint passive ROM and isometric muscle strength were measured using a universal goniometer and a digital hand-held dynamometer, respectively. Paired-sample t-tests were conducted to compare baseline and follow-up measurements. Results Significant improvements (p < 0.05) were observed in passive ROM of hip abduction, straight leg raise, popliteal angle, and ankle dorsiflexion, as well as in isometric strength of hip flexors, extensors, abductors and adductors, knee extensors, and ankle dorsiflexors. Conclusions The SPML procedure supported by postoperative functional physiotherapy can effectively address fixed contractures by significantly increasing passive joint ROM and muscle strength. Further research with longer-term follow-up measurements is necessary to confirm and expand upon these findings.

PMID: 39301341

6. Relation between stretch and activation of the medial gastrocnemius muscle during gait in children with cerebral palsy compared to typically developing children

Eline Flux, Babette Mooijekind, Lynn Bar-On, Edwin H F van Asseldonk, Annemieke I Buizer, Marjolein M van der Krogt

Stretch hyperreflexia is often a target for treatment to improve gait in children with spastic cerebral palsy (CP). However, the presence of stretch hyperreflexia during gait remains debated. Therefore, we assessed the relation between gastrocnemius medialis muscle-tendon stretch and muscle activation during gait in children with CP compared to typically developing (TD) children. 3D gait analysis including electromyography (EMG) and dynamic ultrasound was carried out to assess, respectively gastrocnemius medialis activation and fascicle, belly, and tendon stretch during treadmill walking. Musculotendon-unit stretch was also estimated using OpenSim. Ratios of EMG/peak lengthening velocities and accelerations were compared between CP and TD. Velocity and acceleration peaks prior to EMG peaks were qualitatively assessed. EMG/velocity and EMG/acceleration ratios were up to 500% higher for CP (n = 14) than TD (n = 15) for most structures. Increased late swing muscle activation in CP was often preceded by fascicle and musculotendon-unit peak lengthening velocity, and early stance muscle activation by peaks in multiple structures. Increased muscle activation in CP is associated with muscle-tendon stretch during gait. Concluding, late swing muscle activation in CP appears velocity-dependent, whereas early stance activation can be velocity- and acceleration-dependent. These insights into stretch reflex mechanisms during gait can assist development of targeted interventions.

PMID: 39303491

7. Effects of hippotherapy on motor function of children with cerebral palsy: a systematic review study

Panagiotis Plotas, Angelos Papadopoulos, Evangelia-Maria Apostolelli, Eleni Vlachou, Foteini Gazou, Ioanna Zogopoulou, Ioanna Katsaidoni, Ioanna Panagiotopoulou, Sofia Paraskevi Paparouna, Nikolina Silavou, Katerina Fragkiadaki, Eirini Tsiamaki, Sotirios Fouzas, Xenophon Sinopidis, Nikolaos Trimmis

Cerebral palsy includes a spectrum of neurodevelopmental disorders caused by brain damage, leading to impairment of movement, posture, and balance for a lifetime. There are many therapeutic interventions for cerebral palsy. One of them is hippotherapy, an alternative physical therapy. It is a type of equine-assisted activity and therapy where children with cerebral palsy and motor function skills interact with a horse. We aimed to study the effects of hippotherapy, as an alternative therapy, on the motor function of children with cerebral palsy. We performed a review of the latest literature on hippotherapy and cerebral palsy. The criteria we used were specific keywords, publication date, age of the subjects/studied population, and article type. The outcome of our research resulted in ten relevant studies. The findings demonstrate improvements in various aspects of motor function - more specifically in gross motor function skills, balance, coordination, gait parameters, and muscle strength. Two of ten studies used the Horse-Riding Simulator with significant improvements in postural control in sitting, motor function, and hip abduction range of motion. Hippotherapy can improve motor function skills of children between 2 and 14 years of age with cerebral palsy, affecting their well-being and overall quality of life. It can have a positive effect either as a standalone treatment or as a part of other traditional therapies. Extended research is needed to assess whether hippotherapy may present significant long-term changes in motor skills in children with cerebral palsy.

PMID: 39300490

8. Benefits of inspiratory muscle training therapy in institutionalized adult people with cerebral palsy: A double-blind randomized controlled trial

Carlos Martin-Sanchez, Fausto Jose Barbero-Iglesias, Victor Amor-Esteban, Marta Martin-Sanchez, Ana Maria Martin-Nogueras

Background: Respiratory health problems are one of the main causes of morbidity and mortality in adult people with cerebral palsy (CP). The influence of respiratory muscle training has not yet been studied in this population group. The objective of the study was to evaluate and compare the efficacy of two protocols with inspiratory muscle training (IMT), low intensity and high intensity, to improve respiratory strength and pulmonary function in adults with CP. Methods: The study was a controlled, randomized, double-blind trial with allocation concealment. Twenty-seven institutionalized CP patients were recruited and randomly distributed in the high-intensity training group (HIT) or low-intensity training group (LIT). Over 8 weeks, an IMT protocol was followed 5 days/week, 10 series of 1 min with 1 min rest between them. HIT trained with a load of 40% of the maximum inspiratory pressure (MIP) and LIT with 20%. Respiratory strength and pulmonary function were evaluated. Results: After IMT intervention, MIP, maximum expiratory pressure, forced expiratory volume in 1 s (FEV1) and peak expiratory flow increased in both groups; in HIT 29%, 19%, 13%, and 8%, respectively ($p = 0.000$, $p = 0.000$, $p = 0.002$, $p = 0.001$) and in LIT 17%, 7%, 3%, and 4%, respectively ($p = 0.000$, $p = 0.000$, $p = 0.049$, $p = 0.113$). All the improvements were significantly higher in HIT than in LIT. Conclusion: Inspiratory muscle training improved respiratory muscle strength and pulmonary function in adults with CP. Training with a 40% MIP load improved all the evaluated parameters and was the most effective treatment for adults with CP.

PMID: 39295105

9. Infant sleep spindle measures from EEG improve prediction of cerebral palsy

Erin D Berja, Hunki Kwon, Katherine G Walsh, Sara V Bates, Mark A Kramer, Catherine J Chu

Objective: Early identification of infants at risk of cerebral palsy (CP) enables interventions to optimize outcomes. Central sleep spindles reflect thalamocortical sensorimotor circuit function. We hypothesized that abnormal infant central spindle activity would predict later contralateral CP. Methods: We trained and validated an automated detector to measure spindle rate, duration, and percentage from central electroencephalogram (EEG) channels in high-risk infants ($n = 35$) and age-matched controls ($n = 42$). Neonatal magnetic resonance imaging (MRI) findings, infant motor exam, and CP outcomes were obtained from chart review. Using univariable and multivariable logistic regression models, we examined whether spindle activity, MRI abnormalities, and/or motor exam predicted future contralateral CP. Results: The detector had excellent performance (F1 = 0.50). Spindle rate ($p = 0.005$, $p = 0.0004$), duration ($p < 0.001$, $p < 0.001$), and percentage ($p < 0.001$, $p < 0.001$) were decreased in hemispheres corresponding to future CP compared to those without. In this cohort, PLIC abnormality ($p = 0.004$) and any MRI abnormality ($p = 0.004$) also predicted subsequent CP. After controlling for MRI findings, spindle features remained significant predictors and improved model fit ($p < 0.001$, all tests). Using both spindle duration and MRI findings had highest accuracy to classify hemispheres corresponding to future CP (F1 = 0.98, AUC 0.999). Conclusion: Decreased central spindle activity improves the prediction of future CP in high-risk infants beyond early MRI or clinical exam alone. Significance: Decreased central spindle activity provides an early biomarker for CP.

PMID: 39278086

10. Early Biomarkers in the Prediction of Later Functional Impairment in Preterm Children With Cerebral Palsy

Gabrielle Lambert, Nafisa Husein, Darcy Fehlings, John Andersen, Maryam Oskoui, Michael Shevell; Canadian Cerebral Palsy Registry

Background: To identify early biomarkers that could predict later functional capabilities in preterm children with later cerebral palsy (CP). Methods: Data from 968 preterm children with later CP were extracted from the Canadian Cerebral Palsy Registry. One hundred eighty-two infants were born before 27 weeks of gestation, 461 infants were born between 27 and 33 weeks, and 325 infants were born between 34 and 37 weeks. Univariate and chi-square analyses were conducted to measure the association between early objective biomarkers and later mobility status defined as Gross Motor Function Classification System (GMFCS) levels IV and V as well as tube feeding dependence. Results: Univariate analysis suggested no significant association between GMFCS levels IV and V or impaired feeding status and bilateral white matter injury on magnetic resonance imaging, high-grade intraventricular hemorrhage on head ultrasound, chorioamnionitis, a birth weight of 1000 to 1500 g or <1000 g, as well as an Apgar score of ≤5 at five minutes of life. Similar results were found for gestational age <28 weeks at birth. Only a significant association between GMFCS levels IV and V and a cord or first hour of life pH of ≤7 was reported (mobility status:

odds ratio [OR] 1.95, 95% confidence interval [CI] 1.09 to 3.57) and feeding status: OR 2.23, CI 0.97 to 4.65)]. Conclusions: Prediction of functional outcomes based on specific early biomarkers appears hard to obtain in children with CP born preterm in contrast to those born at term. The complications and causal pathways inherent to prematurity may contribute to making prognostication less determinant.

PMID: 39276578

11. Development and validation of a nomogram for predicting intellectual disability in children with cerebral palsy

Junying Yuan, Gailing Wang, Mengyue Li, Lingling Zhang, Longyuan He, Yiran Xu, Dengna Zhu, Zhen Yang, Wending Xin, Erliang Sun, Wei Zhang, Li Li, Xiaoli Zhang, Changlian Zhu

Int J Clin Health Psychol. 2024 Jul-Sep;24(3):100493. doi: 10.1016/j.ijchp.2024.100493. Epub 2024 Aug 31.

Objective: Intellectual disability (ID) is a prevalent comorbidity in children with cerebral palsy (CP), presenting significant challenges to individuals, families and society. This study aims to develop a predictive model to assess the risk of ID in children with CP. Methods: We analyzed data from 885 children diagnosed with CP, among whom 377 had ID. Using least absolute shrinkage and selection operator regression, along with univariate and multivariate logistic regression, we identified key predictors for ID. Model performance was evaluated through receiver operating characteristic curves, calibration plots, and decision curve analysis (DCA). Bootstrapping validation was also employed. Results: The predictive nomogram included variables such as preterm birth, CP subtypes, Gross Motor Function Classification System level, MRI classification category, epilepsy status and hearing loss. The model demonstrated strong discrimination with an area under the receiver operating characteristic curve (AUC) of 0.781 (95% CI: 0.7504-0.8116) and a bootstrapped AUC of 0.7624 (95% CI: 0.7216-0.8032). Calibration plots and the Hosmer-Lemeshow test indicated a good fit ($\chi 2$= 7.9061, p = 0.4427). DCA confirmed the model's clinical utility. The cases were randomly divided into test group and validation group at a 7:3 ratio, demonstrating strong discrimination, good fit and clinical utility; similar results were found when stratified by sex. Conclusions: This predictive model effectively identifies children with CP at a high risk for ID, facilitating early intervention strategies. Stratified risk categories provide precise guidance for clinical management, aiming to optimize outcomes for children with CP by leveraging neuroplasticity during early childhood.

PMID: 39282221

12. Reliability and validity of the Chinese version of the selective control assessment of the lower extremity in children with spastic cerebral palsy

Chunming Zhou, Yijing Chen, Wenhui Zeng, Wujie Huang, Xuefei Wu, Yating Wang, Jiamin Zhong, Jianguo Cao, Meihuan Huang

Front Neurol. 2024 Sep 4:15:1458066. doi: 10.3389/fneur.2024.1458066. eCollection 2024.

Objective: To assess the reliability and validity of the Chinese version of the Selective Control Assessment of the Lower Extremity (SCALE) in children with spastic cerebral palsy (CP). Methods: Forty-five children with spastic CP (mean age 7.29 years, SD 2.87 years, rang 4-16 years) were recruited. Internal consistency was measured using Cronbach's α, while test-retest and inter-rater reliability were evaluated using intra-class correlation coefficients (ICC). Construct validity was established through correlation and confirmatory factor analyses. Discriminative validity was assessed by comparing SCALE scores across varying GMFCS levels. Results: The Chinese version of SCALE demonstrates high internal consistency (Cronbach's α = 0.91) and good reliability with ICCs exceeding 0.76 for test-retest and inter-rater assessments. It shows significant correlations with GMFCS (r = -0.76, p < 0.001) and Fugl-Meyer scales (r = 0.79, p < 0.001), confirming its validity. Confirmatory factor analysis supports a well-fitting model ($\chi 2$/df = 1.58, RMSEA = 0.08, SRMR <0.001, GFI = 0.98, AGFI = 0.90, CFI = 0.99, TLI = 0.98), with the latent variable's AVE at 0.59 and CR at 0.88. Discriminative validity is evident in significant differences across GMFCS levels (p < 0.001), notably between levels I and II, I and III, and I and IV (p < 0.05). Conclusion: The Chinese version of SCALE shows good reliability and validity for assessing lower limb selective movement control in children with spastic cerebral palsy in China.

PMID: 39296955

13. The nutritional and feeding status of children living in selected residential child care facilities in Zambia: implications for programs and policies

Zeina Makhoul, Mulemba Ndonji, Julie M Long, Carolyn Moore, Edgar Lunda, Watson Mwandileya, Douglas Taren

Front Public Health. 2024 Sep 4:12:1331907. doi: 10.3389/fpubh.2024.1331907. eCollection 2024.

Introduction: This study aimed to estimate the prevalence of undernutrition and risk of feeding difficulties and describe

common feeding practices for children from birth to 10 years of age living in residential care in Zambia. Methods: This was a secondary analysis of de-identified cross-sectional data on 397 children living in 22 residential care facilities in four provinces. Child demographics, anthropometrics, hemoglobin levels, risk for feeding difficulties, and facility-level feeding practices were collected by a trained study team using Count Me In, a digital health app. Interviews with staff were conducted at 15 residential care facilities. Results: Around half of the study sample were boys (53.4%) and <5 years old (55.4%). Special healthcare needs were reported in 10.3% of the children, with cerebral palsy being the most common (3.5%). Underweight, stunting, wasting (using weight-for-length/height), and anemia were found in 22.4, 28.0, 7.1 and 54.7% of children, respectively, with higher rates in children with special healthcare needs and children <24 months old. Duration of residential care was positively associated with length/height-for-age but not weight-for-age or weight-for-length/height z-scores. A risk for feeding difficulties was found in 41.4 and 26.0% of children with and without special healthcare needs, respectively. Suboptimal bottle-feeding practices, including the use of altered nipples and poor caregiver-infant interactions, were observed for infants <12 months old. Residential care staff reported suboptimal diets in their facilities and gaps in knowledge and resources to meet children's nutritional needs. Conclusion: These results demonstrate that a large proportion of children living in residential care in Zambia are at high risk for undernutrition and feeding difficulties and contribute to the small body of literature on children living in residential care, both in Zambia and globally. In the context of Zambia's efforts to improve child nutrition and reform its alternative care, these findings can inform programming and policies for children living in residential care to fulfill their rights to health and family care.

PMID: 39296847

14. The effects of perceived therapist guidance and advice on adherence to home-based exercise programs in mothers of children with cerebral palsy in Rwanda

Japhet Niyonsenga, Liliane Uwingeneye, Inès Musabyemariya, Jean Pierre Nteziryayo, Thèodat Siboyintore, Jean Baptiste Sagahutu, Francesca Cavallini, Rutembesa Eugene, Stefan Jansen, Nadia Monacelli, Luca Caricati, Jean Mutabaruka

Background: The alarming prevalence of non- or poor adherence to Home-based Exercise Programs (34-79.2 %, HEP) in parents of Children with Cerebral Palsy (C-CP) is a global health concern due to its detrimental effect on treatment outcomes. Objective: To examine whether Perceived Therapist Guidance and Advice (TGA) or social support moderate the effects of PTSD, depression, parenting stress, low self-efficacy, the burden of care, or the effects of perceived family stigma on adherence to HEP. Method: A stratified random sample of 301 mothers of C-CP attending the largest seven physical rehabilitation hospitals or centres in Rwanda participated in this study. Data were collected using validated measures of all investigated constructs. We conducted hierarchical multiple linear regressions, and the nature of moderation was scrutinized using the process macro 4.1 model number 1 within SPSS version 28. Results: The prevalence of adherence to HEP in the present sample was 32.9 %. Mothers' TGA and social support were positively associated with adherence to HEP; whereas mothers' stressors, including PTSD, parenting stress, depression symptoms, low self-efficacy, burden of care, and family stigma were negatively associated with adherence to HEP. In addition, TGA significantly moderated the associations of the different mothers' stressors with adherence to HEP, leading to increased HEP adherence for mothers with high stressor levels. Social support did not moderate any of these associations. Our respondents often reported poor family and friends' social support due to family stigma-related to caring C-CP. Conclusions: Therapists play a vital role by providing education, support, and counselling to parents, emphasizing the importance of adherence, and addressing any stigma-related concerns, especially for mothers who experience high levels of stress. Therapists should be aware that mothers of C-CP frequently relied solely on their support to improve adherence to HEP.

PMID: 39296174

15. A randomized-controlled trial of parent-administered interventions to improve short-term motor outcomes in hospitalized very low birthweight infants

L Letzkus, M Conaway, R Daugherty, M Hook, S Zanelli

Background: Premature infants are at increased risk for cerebral palsy (CP). Early interventions with a motor focus and administered by parents may improve motor outcomes. Aims: Secondary study evaluating the short-term motor outcomes and risk for CP in very low birthweight (VLBW) infants randomized to multimodal interventions with a motor focus provided by parents versus usual care. Study design: Randomized controlled trial (intervention vs. usual care (control group)). Subjects: Infants (<32 weeks' gestational age (GA) and/or <1500 grams birthweight) born between March 2019 and October 2020. Outcome measures: Short-term motor outcomes and risk for CP was evaluated using the Hammersmith Infant Neurological Evaluation (HINE, primary motor outcome), the General Movement Assessment (GMA) and the Test of Infant Motor Performance (TIMP) at 3 months' postmenstrual age (PMA). Results: 70 participants were enrolled (GA 28.3±2.7 weeks, birthweight 1139.2±376.6 grams, 64.3% male). The in-person follow-up rate was 73%, lower than expected, in part due to COVID-19 restrictions, resulting in 25 infants (intervention) and 26 infants (control) with outcome data available for analysis.

There was not a significant difference in the HINE, GMA or TIMP at 3 months' PMA between groups. Conclusion: Multimodal interventions with a motor focus and provided by parents need further investigation to determine if they can improve short-term motor outcomes in VLBW infants. These interventions are evidence-based and the evaluation of broader implementation into routine care is also needed.

PMID: 39302384

16. Preoperative neurologic comorbidity and unanticipated early postoperative reintubation: a multicentre cohort study

Christian Mpody, Rachel C Kidwell, Brittany L Willer, Olubukola O Nafiu, Joseph D Tobias

Br J Anaesth. 2024 Sep 19:S0007-0912(24)00471-9. doi: 10.1016/j.bja.2024.08.006. Online ahead of print.

Background: The risk of respiratory complications is highest in the first 72 h post-surgery. Postoperative respiratory events can exacerbate pre-existing respiratory compromise and lead to reintubation of the trachea, particularly in patients with neurologic disorders. This study examined the association between neurologic comorbidities and unanticipated early postoperative reintubation in children. Methods: This multicentre, 1:1 propensity score-matched study included 420 096 children who underwent inpatient, elective, noncardiac surgery at National Surgical Quality Improvement Program reporting hospitals in 2012-22. The primary outcome was unanticipated early postoperative reintubation within 72 h after surgery. The secondary outcome was prolonged postoperative mechanical ventilation, defined as ventilator use >72 h. We also evaluated 30-day mortality in patients requiring reintubation. Results: Cerebral palsy was associated with the highest risk of early reintubation (adjusted relative risk [RRadj]: 1.97, 95% confidence interval [CI]: 1.44-2.69; $P<0.01$), followed by seizure disorders (RRadj: 1.87, 95% CI: 1.50-2.34; $P<0.01$), neuromuscular disorders (RRadj: 1.76, 95% CI: 1.41-2.19; $P<0.01$), and structural central nervous system abnormalities (RRadj: 1.35, 95% CI: 1.13-1.61; $P<0.01$). Unanticipated early postoperative reintubation was associated with an eight-times increased risk of 30-day mortality (adjusted hazard ratio: 8.1, 95% CI: 6.0-11.1; $P<0.01$). Risk of prolonged postoperative mechanical ventilation was also increased with neurologic comorbidities, particularly seizure disorders (RRadj: 1.73, 95% CI: 1.55-1.93; $P<0.01$). Conclusions: Children with neurologic comorbidities have an increased risk of unanticipated early postoperative reintubation and prolonged mechanical ventilation. Given the high mortality risk associated with these outcomes, children with neurologic comorbidities require heightened monitoring and risk assessment.

PMID: 39304468

17. Impairment in understanding grasping movements in egocentric and allocentric perspectives in children with cerebral palsy due to periventricular leukomalacia

Francesca Tinelli, Giulia Purpura, Giovanni Cioni, Maria Concetta Morrone, Marco Turi

Hum Mov Sci. 2024 Sep 19:98:103292. doi: 10.1016/j.humov.2024.103292. Online ahead of print.

Recognizing and understanding the actions of others through motion information are vital functions for social adaptation. Conditions like neurological disorders and motor impairments can impact sensitivity to biological motion, highlighting the intricate relationship between perceiving and executing movements. Our study centred on assessing the ability of children, encompassing both those with typical development and those diagnosed with cerebral palsy due to periventricular leukomalacia (PVL), to discriminate between depicted grasping of a small cylinder and a large cube. This discrimination task involved observing a point-light animation depicting an actor grasping the object, presented from either an allocentric perspective (observing others) or an egocentric viewpoint (observing oneself). Notably, children with PVL exhibited a pronounced and specific impairment in this task, irrespective of the viewpoint, as evidenced by thresholds increasing by nearly a factor of two. When comparing this impairment to difficulties in form or motion perception, we identified a robust correlation between egocentric biological motion and form sensitivity. However, there was no similar correlation between motion and biological motion sensitivity, suggesting a deficit in the visual system rather than the visuo-motor control system. These findings contribute to our understanding of the intricate interplay between motor and visual processing in individuals with congenital brain lesions, shedding light on the significant involvement of the visual system in cases of PVL.

PMID: 39303630

18. Clinical utility and psychometric properties of tools for early detection of developmental concerns and disability in young children: A scoping review

Andrea Burgess, Carly Luke, Michelle Jackman, Jane Wotherspoon, Koa Whittingham, Katherine Benfer, Sarah Goodman, Rebecca Caesar, Tiffney Nesakumar, Samudragupta Bora, David Honeyman, Danielle Copplin, Sarah Reedman, John Cairney, Natasha Reid, Leanne Sakzewski, Roslyn N Boyd

Review Dev Med Child Neurol. 2024 Sep 16. doi: 10.1111/dmcn.16076. Online ahead of print.

Aim: To explore the clinical utility and psychometric properties of standardized tools for the early detection of developmental concerns or disability in young children. Method: Systematic reviews and clinical practice guidelines containing psychometric data on tools appropriate for use with children from birth to 5 years 11 months were searched for in MEDLINE, CINAHL, Embase, and PsycINFO for the years 2000 to 2023, with no language restrictions. Results: Eighty-six systematic reviews and six clinical practice guidelines guided identification of tools. A total of 246 tools were identified across domains of neurological, motor, cognition, communication/language, social-emotional, sensory processing, and/or specific diagnostic conditions of attention-deficit/hyperactivity disorder, autism spectrum disorder, cerebral palsy, developmental coordination disorder, and fetal alcohol spectrum disorder. After critical evaluation, 67 tools were included in the recommendations. Recommendations for screening and diagnostic assessment tools were based on best available evidence for predictive and discriminative validity, diagnostic accuracy, together with consideration of resource use and accessibility. Interpretation: This comprehensive scoping review provides recommendations on the best tools for primary care, medical, allied health professionals, nursing, and other health workers to detect and identify developmental concerns or disability in young children using evidence-based tools.

PMID: 39285306

19. Unplanned hospital readmission after cholecystectomy in adults with cerebral palsy

Lucas Weiser, Matthew Y C Lin

Background: Adults with cerebral palsy (CP) are a largely understudied, growing population with unique health care requirements. We sought to establish a deeper understanding of the surgical risk in adults with CP undergoing a common general surgical procedure: cholecystectomy. Methods: Data were obtained from the State Inpatient Database developed for the Healthcare Cost and Utilization Project. Inclusion criteria included patients ≥ 18 years with CP and a primary ICD-9 procedure code indicating open or laparoscopic cholecystectomy. Demographics, procedure-related factors, and comorbid conditions were analyzed, and unplanned 30 and 90 day readmission rates calculated for each variable. Reasons for readmission based on ICD-9 diagnosis codes were grouped into relevant categories. Univariate analysis identified factors significantly associated with readmission rates. Results: A total of 802 patients with CP met the inclusion criteria. Unplanned 30 and 90 day readmission rates after laparoscopic cholecystectomy were 11.4% and 18.1%, respectively. Average length of stay (LOS) after laparoscopic cholecystectomy was 7.1 days. After open cholecystectomy, 30 and 90 day readmission rates were 16.9% and 30.3% with an average LOS of 14.6 days. Infection was the most common cause for 30 and 90 day readmission. Factors associated with 30 day readmission included type of cholecystectomy, LOS, discharge to skilled nursing facility, and comorbid diabetes and malnutrition. Factors associated with 90 day readmission included type of cholecystectomy, LOS, discharge to skilled nursing facility, and comorbid heart failure, renal disease, epilepsy, and malnutrition. Conclusion: Unplanned readmission rates after open and laparoscopic cholecystectomy in adult patients with CP are much higher than previously demonstrated rates in the general population. These patients frequently suffer multiple comorbid conditions that significantly complicate their surgical care. As more and more of these patients live longer into adulthood, further study is warranted to grasp the perioperative risk of simple and complex surgical procedures.

PMID: 39285045

20. Novel extracorporeal treatment for severe neonatal jaundice: a mathematical modelling study of allo-hemodialysis

Vaibhav Maheshwari, Maria Esther Díaz-González de Ferris, Guido Filler, Peter Kotanko

Severe Neonatal Jaundice (SNJ) causes long-term neurocognitive impairment, cerebral palsy, auditory neuropathy, deafness, or death. We developed a mathematical model for allo-hemodialysis as a potential blood purification method for the treatment of SNJ in term or near-term infants. With allo-hemodialysis (allo-HD), the neonate's blood flows through hollow fibers of a miniature 0.075 m2 hemodialyzer, while the blood of a healthy adult ("buddy") flows counter-currently through the dialysate compartment. We simulated the kinetics of unconjugated bilirubin in allo-hemodialysis with neonate blood flow rates of 12.5 and 15 mL/min (for a 2.5 kg and 3.5 kg neonate, respectively), and 30 mL/min for the buddy. Bilirubin production rates in neonate and buddy were set to 6 and 3 mg/kg/day, respectively. Buddy bilirubin conjugation rate was calculated to obtain normal steady-state bilirubin levels. Albumin levels were set to 1.1, 2.1, 3.1 g/dL for the neonate and 3.3 g/dL for the buddy. Model simulations suggest that a 6-h allo-hemodialysis session could reduce neonatal bilirubin levels by > 35% and that this modality would be particularly effective with low neonatal serum albumin levels. Due to the high bilirubin conjugation capacity of an adult's healthy liver and the larger distribution volume, the buddy's bilirubin level increases only transiently during allo-hemodialysis. Our modelling suggests that a single allo-hemodialysis session may lower neonatal unconjugated bilirubin levels effectively. If corroborated in ex-vivo, animal, and clinical studies, this bilirubin reduction could lower the risks associated with SNJ, especially kernicterus, and possibly avoiding the morbidity associated with exchange transfusions.

PMID: 39300159

21. Elevated cerebral perfusion in neonatal encephalopathy is associated with neurodevelopmental impairments

Ruth O'Gorman Tuura, Raimund Kottke, Barbara Brotschi, Carola Sabandal, Cornelia Hagmann, Beatrice Latal

Background: Neonatal encephalopathy (NE) represents a primary cause of neonatal death and neurodevelopmental impairments. In newborns with NE, cerebral hyperperfusion is related to an increased risk of severe adverse outcomes, but less is known about the link between perfusion and mild to moderate developmental impairments or developmental delay. Methods: Using arterial spin labelling perfusion MRI, we investigated the link between perfusion in 36 newborns with NE and developmental outcome at 2 years. Results: 53% of the infants demonstrated a normal outcome at 24 months, while two had cerebral palsy with impairments in cognitive, motor, and language domains, and three infants died. The remaining infants showed mild or moderate delays in development in one or two domains. Hyperperfusion across the whole brain was associated with more adverse outcome, including an increased risk of death or severe disability such as cerebral palsy. Among the surviving infants, higher perfusion in the bilateral basal ganglia, thalamus, hippocampus and cerebellum during the neonatal period was related to a poorer cognitive outcome at 2 years. Conclusion: Hyperperfusion in infants with NE was associated with a more adverse outcome and lower cognitive outcome scores. In addition to severe adverse outcomes, altered perfusion is also related to mild to moderate impairment following HIE. Impact statement: Neonates with neonatal encephalopathy (NE) show increased cerebral perfusion globally, which is linked to a more adverse outcome. Higher perfusion in the bilateral basal ganglia, thalamus, hippocampus and cerebellum during the neonatal period was related to a poorer cognitive outcome at 2 years. In addition to severe adverse outcomes altered perfusion is related to mild to moderate impairment following NE. To improve neurodevelopmental outcomes, it is important to improve our understanding of the factors influencing cerebral perfusion in infants with NE.

PMID: 39289590

22. Comparison of the Effect of Two Therapeutic Interventions for the Treatment of Chronic Constipation in Children With Cerebral Palsy: A Randomized Clinical Trial

Gholamreza Yousefi-Fatmesari, Roya Chegene Lorestani, Mosayeb Rostamian, Sepideh Khodamoradi, Mostafa Sedighi, Hooman Daryoushi, Masoud Norouzi, Jamal Hoseini, Keyghobad Ghadiri

Objectives. Constipation is one of the most common gastrointestinal symptoms in children with neurological disorders. This study was performed to compare the therapeutic effect of polyethylene glycol (PEG) plus domperidone with PEG plus placebo in the treatment of chronic constipation in children with cerebral palsy. Methods. In this a double-blind clinical trial study was done on the children with cerebral palsy who had chronic constipation and was referred to Mohammad Kermanshahi hospital of Kermanshah city in the west of Iran. The participants were randomly divided into 2 groups with 2 therapies of PEG combined with domperidone (case group, n = 21) and PEG with placebo (control group, n = 21). The information was extracted from patients based on the checklist before and after treatment and the response to treatment in the 2 groups were determined and compared. The data were analyzed by T-test or Mann-Whitney U test to compare quantitative variables and Chi-square and Fisher's exact tests for comparing qualitative variables. Results. In both case and control groups, all Rome IV criteria for a diagnosis of chronic constipation except incontinence were significantly reduced after treatment. However, the successful response rate in the case group (PEG + domperidone) was 90.5%, while this rate was 61.9% in the control group. Conclusion. Based on the results of the present study, it seems that PEG plus domperidone had a positive effect on the treatment of children with cerebral palsy and chronic constipation.

PMID: 39281353

23. Grand Rounds: How Do We Detect Cerebral Palsy Earlier in Neonates ?

Faith Kim, Nathalie Maitre

No abstract available

PMID: 39277080