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Monday 13 June 2022

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Interventions and Management

1. Neuromuscular Electrical Stimulation of Upper Extremities in Patients with Cerebral Palsy: A systematic review and Meta-Analysis of Randomized Controlled Trials
Chih-Hung Ou, Chian-Chuan Shiue, Yi-Chun Kuan, Tsan-Hon Liou, Hung-Chou Chen, Ting-Ju Kuo

Am J Phys Med Rehabil. 2022 Jun 9. doi: 10.1097/PHM.0000000000002058. Online ahead of print.

Objective: To assess the effects of neuromuscular electrical stimulation on the upper extremities of patients with cerebral palsy. Design: We searched PubMed, Cochrane, Embase, and Scopus databases for randomized controlled trials examining the effects of neuromuscular electrical stimulation on the upper extremities of children with cerebral palsy. Results: Eight randomized controlled trials (n = 294) were included in the meta-analysis. Compared with traditional physical therapy, sensorimotor training and task-oriented training, constraint-induced movement therapy, dynamic bracing, and conventional robot-assisted therapy, neuromuscular electrical stimulation in combination with these therapies resulted in significantly greater functional scale scores (standardized mean difference (SMD): 0.80; 95% confidence interval [CI]: 0.54-1.06), muscle strength of upper extremities (SMD: 0.57; 95% CI: 0.25-0.88), and spasticity of upper extremities (relative risk [RR]: 2.53; 95% CI: 1.46-4.39) (SMD: -0.18; 95% CI: -0.29 to -0.06) but did not improve the wrist range of motion (SMD: 0.43; 95% CI: -0.04-0.91). In addition, the effect of neuromuscular electrical stimulation on functional scale scores remained after 3 months of follow-up (SMD: 0.68; 95% CI: 0.16-1.2). Conclusion: Neuromuscular electrical stimulation effectively improved hand function, muscle strength, and spasticity in patients with cerebral palsy.

PMID: 35687763

2. Imaging Parameters of Hip Dysplasia in Cerebral Palsy: A Systematic Review
Sitanshu Barik, Aakash Jain, Hawaibam Nongdamba, Sunny Chaudhary, Rama Priya Yasam, Tarun Goyal, Vivek Singh

Review Indian J Orthop. 2022 Feb 19;56(6):939-951. doi: 10.1007/s43465-022-00610-x. eCollection 2022 Jun.

Background: Cerebral Palsy is the leading cause of childhood physical disability globally. The motor disorders of CP are often associated with musculoskeletal anomalies, of which hip displacement is the second most common abnormality after abnormalities of foot and ankle. Various radiological parameters have been described in the literature which detects and quantifies hip dysplasia, with MP being the current gold standard. This study aims to review these radiological indicators of hip dysplasia in children with cerebral palsy from the published literature. Methods: A literature search using PubMed, Embase, and Google Scholar was done on 15th June 2021 focusing on surveillance of hip dysplasia in cerebral palsy. The studies to be included were to have used anyone or more radiological parameter for detection of hip dysplasia with the use of any of the radiological methods. Results: The initial search yielded 1184 results. After the screening of the abstracts and full texts, a final of 30 studies was included for this systematic review. The majority of the studies were graded as Level 3

evidence (16/30), followed by Level 2 studies (14/30). X-ray was the most common modality of detection of dysplasia followed by CT scan, ultrasonography, and arthrogram. The reproducibility of the various parameters shows good to excellent intraclass coefficients. Conclusions: Parameters other than MP can be used to screen hips in CP. This would be useful in patients in whom either the lateral acetabular edge is not discernible on a plain anteroposterior radiograph or there are issues in the positioning of the patient. Additional views and structures can be visualized which can lead to improved screening and planning. Further investigations are required to appreciate the full potential of these parameters and how they can be better utilized.

PMID: 35669024

3. Incidence and Risk Factors for Concurrent Syndromic Diagnosis in Presumed Idiopathic Developmental Dysplasia of the Hip
F Keith Gettys, Adriana De La Rocha, Brandon A Ramo

J Am Acad Orthop Surg Glob Res Rev. 2022 Jun 6;6(6):e21.00169. doi: 10.5435/JAAOSGlobal-D-21-00169. eCollection 2022 Jun 1.

Background: Infants referred for developmental dysplasia of the hip (DDH) may have a previously unidentified concomitant diagnosis of syndromic pathology. Our purpose was to examine the incidence of syndromic pathology in infants referred to a tertiary center with presumed idiopathic DDH and identify risk factors and difference in treatment courses between idiopathic and nonidiopathic cohorts. Methods: A retrospective analysis of a prospective cohort of infants younger than 3 years who were evaluated for DDH between 2008 and 2013 with a minimum 2-year follow-up. The clinical history and treatment were noted to determine the incidence and nature of concomitant syndromic diagnoses, after a confirmed diagnosis of DDH. Results: There were 202 patients: 177 were females (87.6%). Thirteen patients (6.4%) were later diagnosed with a neurologic/syndromic diagnosis. The workup leading to additional diagnosis was initiated by the orthopaedic surgeon in 8 of 13 patients (61.5%). Half of the referrals (4 of 8) made to other specialists were because of an abnormal treatment course (three-failure of typical DDH treatment and one-relapsed clubfeet). 7 of the 8 referrals were made because of developmental delays and decreased tone. 5 of the 13 nonidiopathic patients had other orthopaedic problems. The syndromic diagnoses included three cerebral palsy, two Kabuki syndrome, one Down syndrome, one myopathy, and one neuropathy. The diagnosis was made at an average of 2.3 years (0.04 to 4.7). No notable difference was observed in the incidence of the four known risk factors for DDH in syndromic patients compared with the idiopathic group. The syndromic patients required more open reductions (P = 0.002). Discussion: By the age of 3 years, 6% of the patients treated for DDH were found to have a syndrome or neurologic abnormality, and the referral for workup was made by the treating surgeon greater than 60% of the time.

PMID: 35666487

4. Long-term outcomes of hip reconstruction surgery in children with GMFCS III diplegic cerebral palsy
Alina Badina, Xavier du Cluzel de Remaurin, Nejib Khouri

Orthop Traumatol Surg Res. 2022 Jun 2;103344. doi: 10.1016/j.otsr.2022.103344. Online ahead of print.

Introduction: The results of hip reconstruction surgery are known for non-walking (GMFCS IV and V) and walking (GMFCS I and II) patients. Few studies deal with GMFCS III patients in isolation. Their intermediate functional status can be deteriorated by asymmetrical contractures, hip dislocation, multi-level deformities of the lower limbs, leading to motor function degradation, and possibly losing their ability to walk. The aim of our study was to establish whether surgical results were maintained over time and whether the functional status changed. Material and methods: Fifteen patients with GMFCS III spastic diplegia, treated for hip subluxation, were reviewed. The mean age at the time of surgery was 10 years old. The mean follow-up after surgery was 11 years. Reconstructive surgery was performed on 21 hips including pelvic osteotomy in all cases, with associated femoral osteotomy in 19 cases. Clinical (pain, joint mobility, walking aids, walking distance, GMFCS level) and radiological data (Melbourne Cerebral Palsy Hip Classification, standard coxometry) were recorded preoperatively and at the last follow-up. Results: Preoperatively, 6 patients were losing their ability to walk due to pain and flexion-adduction contracture. At the last follow-up, no patients had pain and joint mobility was improved in all cases. For one patient, recovery to their previous functional state required a period of two years. In the long term, 14 patients were GMFCS III and only one patient was GMFCS IV due to reasons unrelated to hip surgery. The radiological parameters improved significantly. The Melbourne score was IV preoperatively for all patients. At the last follow-up, 10 hips were grade I, 6 hips were grade II and 5 hips were grade III. Discussion: Correction of architectural disorders of the subluxed hip by pelvic osteotomy, in most cases

associated with femoral osteotomy, improves functional and radiological status for GMFCS III patients. This improvement is maintained in the long-term. Complementary surgeries correcting the other deformities of the lower limbs were necessary in more than half of the patients. Level of evidence: IV.

PMID: 35660081

5. Ballistic strength training in adults with cerebral palsy may increase rate of force development in plantar flexors, but transition to walking remains unclear: a case series
Beate Eltarvåg Gjesdal, S Mæland, B Bogen, K T Cumming, V C Nesse, S M R Torberntsson, C B Rygh

BMC Sports Sci Med Rehabil. 2022 Jun 3;14(1):101. doi: 10.1186/s13102-022-00487-1.

Background: Persons with cerebral palsy (CP) walk with reduced ankle plantar flexor power compared to typically developing. In this study, we investigated whether a ballistic strength-training programme targeting ankle plantar flexors could improve muscle strength, muscle architecture and walking function in adults with CP. Methods: Eight adults (mildly affected CP) underwent eight weeks of ballistic strength training, with two sessions per week. Before and after the intervention preferred walking speed, ankle plantar flexion rate of force development (RFD), maximal voluntary contraction (MVC), muscle thickness, pennation angle and fascicle length were measured. Data are presented for individuals, as well as for groups. Group changes were analysed using the Wilcoxon signed-rank test. Results: Data were analysed for eight participants (five women, mean age 37.9 years; six GMFCS I and two GMFCS II). Two participants increased their walking speed, but there were no significant group changes. In terms of muscle strength, there were significant group changes for RFD at 100 ms and MVC. In the case of muscle architecture, there were no group changes. Conclusion: In this study, we found that eight weeks of ballistic strength training improved ankle plantar flexor muscle strength but walking function and muscle architecture were unchanged. Larger studies will be needed to obtain conclusive evidence of the efficacy of this training method.

PMID: 35659348

6. Grice extra-articular subtalar fusion for spastic pes planovalgus
Phatcharapa Osateerakun, Supitchakarn Cheewasukanon, Noppachart Limpaphayom

Int Orthop. 2022 Jun 6. doi: 10.1007/s00264-022-05455-5. Online ahead of print.

Introduction: A pes planovalgus deformity, an unstable foot deformity, affects the gait of children with cerebral palsy (CP). Treatments, including subtalar fusion, were proposed. The Grice procedure maintains foot stability, but bone graft non-union poses a challenge. This study aimed to identify the rate and factors related to post-operative bone graft non-union. Methods: Thirty-one paediatric CP patients (age, 8.9 ± 1.8 years) who underwent the Grice procedure (53 feet) using ipsilateral tibial bone grafts were reviewed. Pre-operative gross motor function classification system (GMFCS) classes were class 1 in five, 2 in five, 3 in 14, and 4 in seven patients. Standing foot radiographs were assessed for signs of non-union, and parameters (talocalcaneal and talar declination angles and talar head uncovering index) measured pre-operatively, post-operatively, and at the most recent evaluation were compared. Factors associated with bone graft non-union were analysed by regression analysis. $P < 0.05$ was considered statistically significant. Degenerative changes in hindfoot joints were evaluated by Bargon's criteria. Results: At the average follow-up evaluation at 5.4 ± 4.3 years, the GMFCS class was improved or was maintained in 29/31 patients. Post-operative radiographic measurements were restored and were maintained over the follow-up period ($P < 0.001$). A total of 14/53 feet (26%) had non-union. The pre-operative lateral talocalcaneal angle (OR 1.08, $p = 0.04$) and follow-up duration (OR 1.18, $p = 0.03$) were identified in univariate analysis as potential factors related to non-union but were not confirmed in a multivariate model. Hindfoot joints in most feet showed mild degenerative changes. Conclusion: Grice subtalar fusion in patients with a higher pre-operative lateral talocalcaneal angle might lead to bone graft non-union.

PMID: 35666301

7. Effect of Motor Intervention for Infants and Toddlers With Cerebral Palsy: A Systematic Review and Meta-analysis
Aubrey Baker, Natalie Niles, Lynn Kysh, Barbara Sargent

Pediatr Phys Ther. 2022 Jun 7. doi: 10.1097/PEP.0000000000000914. Online ahead of print.

Purpose: To conduct a systematic review and meta-analysis on the effect of motor intervention on motor function of infants and toddlers with cerebral palsy (CP). Methods: Four databases were searched for randomized controlled trials (RCTs) of motor interventions for children with or at high risk of CP younger than 36 months. Studies were excluded if less than 50% of children developed CP. Results: Eleven RCTs included 363 children; 85% diagnosed with CP. Very low-quality evidence supports that: (1) task-specific motor training was more effective than standard care for improving motor function (small effect), (2) constraint-induced movement therapy (CIMT) may be more effective than bimanual play or massage for improving function of the more affected hand (moderate effect), and high-intensity treadmill training is no more effective than low-intensity for improving walking. Conclusions: Very low-quality evidence supports that task-specific motor training and CIMT may improve motor function of infants and toddlers with CP.The Supplemental Digital Content Video Abstract is available at: http://links.lww.com/PPT/A382.

PMID: 35671383

8. Does Hippotherapy Improve the Functions in Children with Cerebral Palsy? Systematic Review Based on the International Classification of Functioning
Eric Pantera, Priscilla Froment, Didier Vernay

J Integr Complement Med. 2022 Jun 7. doi: 10.1089/jicm.2021.0417. Online ahead of print.

Objective: To perform a systematic review of the literature regarding scientific reality of hippotherapy in children with cerebral palsy graded according to France HAS (Haute Autorité de Santé) recommendations and applied to the International Classification of Functioning. Methods: The research in MEDLINE and Cochrane Library databases was performed using the keywords: "Equestrian therapy," "Riding for the disabled," "Hippotherapy," "Equine-movement therapy," and "Therapeutic horse (back) riding." The methodological quality of the articles was assessed using four levels of proof and three guideline grades (A: strong; B: moderate; C: poor). Results: Seven prospective, randomized controlled studies and one systematic review confirm the level of proof of hippotherapy in children with cerebral palsy with grade B. Hippotherapy in children with cerebral palsy contributes to improve motor function, symmetry of muscle contraction, spasticity, posture, and walking. Fifty prospective no randomized studies confirm the level with grade C for balance, motor coordination, lumbopelvic mobility, walking speed, functional development, and social behavior. Conclusions: Hippotherapy in children with cerebral palsy can be recommended. Regarding the literature data, the level of proof of hippotherapy in children with cerebral palsy is moderate (grade B).

PMID: 35671520

9. Equine-Assisted Therapies for Children With Cerebral Palsy: A Meta-analysis
Nicole Heussen, Martin Häusler

Pediatrics. 2022 Jun 3;e2021055229. doi: 10.1542/peds.2021-055229. Online ahead of print.

Context: Equine-assisted therapy in different facets aims to improve the clinical condition of children with cerebral palsy. A more comprehensive overview on the overall effects and on the differences between different treatment modalities seems desirable. Objective: We compared the effectiveness of various equine-assisted treatments on motor capabilities and quality of life of children with cerebral palsy. Data sources: We conducted systematic searches of PubMed, Embase, Web of Science, and the Cochrane Central Register of Controlled Trials. Study selection: Randomized and nonrandomized controlled parallel-group or crossover studies on equine-assisted therapies in comparison with standard of care were included. Data extraction: Data on motor function assessed by different instruments were considered as the primary outcome. Secondary outcomes included global, social, physical, and emotional scores of quality of life. Results: Strong evidence for a positive effect of equine-assisted therapies, particularly hippotherapy, on global gross motor function and motor capabilities during walking in children with

cerebral palsy was identified (SMD 0.24, 95% CI 0.05 to 0.43, P = .01, t2 = 0.00, I2 = 15%; SMD 2.68, 95% CI 1.02 to 4.34, P = .002, t2 = 0.0, I2 = 0%). No evidence for the improvement in quality of life could be shown in the global assessment, nor in any subscore. Conclusions: Equine-assisted therapy, particularly hippotherapy, can be a therapeutic tool for children who are learning to walk. Limitation: The heterogeneity of tools used in different studies and the low number of studies addressing quality of life issues limited the number of studies available for distinct analyses.

PMID: 35656779

10. Gross motor function prediction using natural language processing in cerebral palsy
Kelly Greve, Yizhao Ni, Amy F Bailes, Jilda Vargus-Adams, Aimee E Miley, Bruce Aronow, Mary M McMahon, Brad G Kurowski, Alexis Mitelpunkt

Dev Med Child Neurol. 2022 Jun 5. doi: 10.1111/dmcn.15301. Online ahead of print.

Aim: To predict ambulatory status and Gross Motor Function Classification System (GMFCS) levels in patients with cerebral palsy (CP) by applying natural language processing (NLP) to electronic health record (EHR) clinical notes. Method: Individuals aged 8 to 26 years with a diagnosis of CP in the EHR between January 2009 and November 2020 (~12 years of data) were included in a cross-sectional retrospective cohort of 2483 patients. The cohort was divided into train-test and validation groups. Positive predictive value, sensitivity, specificity, and area under the receiver operating curve (AUC) were calculated for prediction of ambulatory status and GMFCS levels. Results: The median age was 15 years (interquartile range 10 -20 years) for the total cohort, with 56% being male and 75% White. The validation group resulted in 70% sensitivity, 88% specificity, 81% positive predictive value, and 0.89 AUC for predicting ambulatory status. NLP applied to the EHR differentiated between GMFCS levels I-II and III (15% sensitivity, 96% specificity, 46% positive predictive value, and 0.71 AUC); and IV and V (81% sensitivity, 51% specificity, 70% positive predictive value, and 0.75 AUC). Interpretation: NLP applied to the EHR demonstrated excellent differentiation between ambulatory and non-ambulatory status, and good differentiation between GMFCS levels I-II and III, and IV and V. Clinical use of NLP may help to individualize functional characterization and management.

PMID: 35665923

11. Development of social participation classification system for children with cerebral palsy
Seyed Hassan Saneii, Malek Amini, Marzieh Pashmdarfard

Med J Islam Repub Iran. 2021 Dec 23;35:173. doi: 10.47176/mjiri.35.173. eCollection 2021.

Background: Some classification systems have been designed to measure domains of function of children with cerebral palsy (CP), including the Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS), Eating and Drinking Ability Classification System (EDACS), and Communication Function Classification System (CFCS). The purpose of the present study was to develop a Social Participation Classification System for children with cerebral palsy (SPCS) with a 5-level sequential scale (level 1 the lowest and level 5 the highest level of participation) and assess its reliability. Methods: In this cross-sectional analytic study, 274 parents of 6 to 12 year-old children with CP were asked to complete the questionnaires (CPAS-P, MACS, GMFCS, and CFCS) for their child. The expert review consisting of 10 occupational therapists with at least 5 years of experience working with children with CP was asked to rate the level of social participation with a 5-level sequential scale (level 1 the lowest and level 5 the highest level of participation) of these children according to the variables (intelligent quotient [IQ], CP type, walking ability, GMFCS, CFCS, and MACS). Then, these data were analyzed using the polynomial discriminant function. After performing discriminant function, a flowchart model was determined for the level of children's social participation. To calculate the reliability of the model, 53 new samples were collected and their level of social participation was determined based on the flowchart model. The experts were then asked to determine the social participation level of these 53 new samples in the same manner as before, and then to calculate reliability, intraclass correlation coefficient (ICC) and Cronbach alpha. The SPSS Version 22 (SPSS Inc) and discriminant function model analysis was used for statistical analysis. Results: Based on the discriminant function model, the results between the predicted classification and expert review are over 88% consistent. The ICC and Cronbach alpha values were 0.952 and 0.975, respectively, with absolute agreement and multivariate mixed effects. Conclusion: Based on the results of the present study, the SPCS was developed in 5 levels (very low, low, moderate, high, and very high) and to determine it, the GMFCS, MACS, and CFCS scores, CP type, and IQ level should be calculated.

PMID: 35685197

12. Correlates of Mental Health in Adolescents and Young Adults with Cerebral Palsy: A Cross-Sectional Analysis of the MyStory Project
Jan Willem Gorter, Darcy Fehlings, Mark A Ferro, Andrea Gonzalez, Amanda D Green, Sarah N Hopmans, Dayle McCauley, Robert J Palisano, Peter Rosenbaum, Brittany Speller, On Behalf Of The MyStory Study Group

J Clin Med. 2022 May 29;11(11):3060. doi: 10.3390/jcm11113060.

Background: It is important to gain a better understanding of mental health issues in adolescents and young adults (AYA) with cerebral palsy (CP). In this cross-sectional study, we explore if demographics, social and clinical questionnaire scores, and cortisol levels in hair samples from AYA with CP are associated with higher scores on anxiety and/or depression questionnaires. Methods: Data from a community-based sample of 63 AYA with CP (30 females; ages 16 to 30 (median age of 25)) were analyzed. Forty-one (65%) participants (20 females) provided a hair sample. Outcomes were assessed using bivariate linear regression analyses and hierarchical regression analyses. Results: Clinical depressive and anxiety symptoms were present in 33% and 31% of participants, respectively. Family functioning, B = 9.62 (95%CI: 5.49-13.74), fatigue, B = 0.15 (95%CI: 0.05-0.25), and pain, B = 1.53 (95%CI: 0.48-2.58) were statistically significant predictors of depressive symptoms. Fatigue, B = 0.24 (95%CI: 0.12-0.35) and pain, B = 1.63 (95%CI: 0.33-2.94) were statistically significant predictors of anxiety. Cortisol levels from hair samples were not found to be associated with depressive symptoms or anxiety. Conclusions: A high prevalence of mental health problems and co-occurring physical problems was found in AYA with CP. Integrating mental support into regular care for AYA with CP is recommended.

PMID: 35683448

13. Parenting Acceptance and Commitment Therapy: An RCT of an online course with families of children with CP
Koa Whittingham, Jeanie Sheffield, Catherine Mak, Ashleigh Wright, Roslyn N Boyd

Behav Res Ther. 2022 May 26;155:104129. doi: 10.1016/j.brat.2022.104129. Online ahead of print.

Aim: To test an online course Parenting Acceptance and Commitment Therapy (PACT) in an RCT with families of children with cerebral palsy (CP), predicting improvements in emotional availability and parent and child adjustment. Method: 67 families of children (2-10 years) with CP participated. Families were randomly assigned to waitlist control or PACT. Assessments at baseline, post-intervention and at six-month follow up (durability of intervention effects) focussed on emotional availability, adjustment and quality of life. Analysis consisted of repeated measure linear regression models. Results: At postintervention (T2), an intervention effect was demonstrated for two aspects of observed emotional availability: parental non-intrusiveness MD = 0.68 (-0.56 to 1.92), p = 0.050 and child involvement, MD = 0.91 (-0.36 to 2.18), p = 0.011. An intervention effect was also found for the parent-reported emotional availability in terms of child involvement. Further intervention effects were found in parent-report measures of child quality of life (social wellbeing and acceptance, participation and physical health), parental mindfulness, parental acceptance, support, social connection, and meaning. No effects were found on parent or child adjustment. Analyses focussed on durability of intervention effect, collapsed across groups, indicated that effects persisted at 6 month follow up (T4). Interpretation: PACT demonstrated an intervention effect for two aspects of emotional availability-parental non-intrusiveness and child involvement-as well as parental mindfulness and child quality of life. Parents reported increased comfort with the CP diagnosis, higher likelihood to seek support, higher likelihood to stay connected to others and greater meaningful living. PACT is an effective online/telehealth parenting support intervention for parents of children with CP.

PMID: 35662680

14. Biofeedback assisted relaxation training and distraction therapy for pain in children undergoing botulinum neurotoxin A injections: A crossover randomized controlled trial
Katarina Ostojic, Simon P Paget, Annabel Webb, George P Khut, Angela M Morrow

Dev Med Child Neurol. 2022 Jun 5. doi: 10.1111/dmcn.15303. Online ahead of print.

Aim: To compare biofeedback assisted relaxation training (BART) with distraction therapy for pain during botulinum neurotoxin A (BoNT-A) treatment. Method: This was a crossover randomized controlled trial. Eligible participants were 7

years and older with neurological conditions. Participants were randomized to receive BART or distraction during their first BoNT-A treatment, followed by the alternative intervention in their subsequent BoNT-A treatment. BART was delivered via BrightHearts, an interactive heart-rate-responsive application. Outcomes were pain (Faces Pain Scale - Revised), fear (Children's Fear Scale), and anxiety (numerical rating scale, State-Trait Anxiety Inventory). Demographics, paired t-tests, and linear mixed models were used to compare outcomes. Results: Thirty-eight participants (mean [SD] age 13 years 5 months [3 years 4 months], 20 males, 34 with cerebral palsy) completed both interventions. There were non-significant differences in overall pain (mean difference - 0.05, 95% confidence interval [CI] -0.91 to 0.80, p = 0.902) and worst pain (mean difference 0.37, 95% CI -0.39 to 1.13, p = 0.334) when using BART and distraction therapy. There were non-significant differences in fear and anxiety between interventions. Younger age, heightened pre-procedural state anxiety, and Gross Motor Function Classification System levels III and IV were associated with poorer outcomes (p < 0.05). Participants who received BART before distraction therapy reported lower pain and anxiety scores during both BoNT-A treatments (p < 0.05). Interpretation: Children reported similar pain when using BART and distraction therapy. Those who used BART before distraction therapy reported lower pain and anxiety during both treatments.

PMID: 35665493

15. Management of sleep disorders among children and adolescents with neurodevelopmental disorders: A practical guide for clinicians
Michael O Ogundele, Chinnaiah Yemula

Review World J Clin Pediatr. 2022 Mar 15;11(3):239-252. doi: 10.5409/wjcp.v11.i3.239. eCollection 2022 May 9.

There is a complex relationship between sleep disorders and childhood neurodevelopmental, emotional, behavioral and intellectual disorders (NDEBID). NDEBID include several conditions such as attention deficit/hyperactivity disorder, autism spectrum disorder, cerebral palsy, epilepsy and learning (intellectual) disorders. Up to 75% of children and young people (CYP) with NDEBID are known to experience different types of insomnia, compared to 3% to 36% in normally developing population. Sleep disorders affect 15% to 19% of adolescents with no disability, in comparison with 26% to 36% among CYP with moderate learning disability (LD) and 44% among those with severe LD. Chronic sleep deprivation is associated with significant risks of behavioural problems, impaired cognitive development and learning abilities, poor memory, mood disorders and school problems. It also increases the risk of other health outcomes, such as obesity and metabolic consequences, significantly impacting on the wellbeing of other family members. This narrative review of the extant literature provides a brief overview of sleep physiology, aetiology, classification and prevalence of sleep disorders among CYP with NDEBIDs. It outlines various strategies for the management, including parenting training/psychoeducation, use of cognitive-behavioral strategies and pharmacotherapy. Practical management including assessment, investigations, care plan formulation and follow-up are outlined in a flow chart.

PMID: 35663001

16. The Effect of a Virtual Reality-mediated Gamified Rehabilitation Program on Upper Extremity Functions in Children with Hemiplegic Cerebral Palsy: A Prospective, Randomized Controlled Study
Ahmet Kivanc Menekseoglu, Nalan Capan, Sina Arman, Ayse Resa Aydin

Am J Phys Med Rehabil. 2022 Jun 9. doi: 10.1097/PHM.0000000000002060. Online ahead of print.

Objective: To investigate the effects of a virtual reality-mediated gamified rehabilitation program on upper extremity functions, skills, range of motion, muscle tone, and quality of life in children with hemiplegic cerebral palsy. Design: This prospective, randomized and controlled study included 36 children with hemiplegic cerebral palsy. Children were randomized into two groups, the virtual reality group (n = 18) and the control group (n = 18). Stretching and range of motion exercises were performed on the affected upper extremity of the children in both groups. In addition to this exercise program, in the virtual reality group, virtual reality-mediated upper extremity rehabilitation was performed under supervision. The children were assessed at baseline and 1 and 3 months after the intervention. Results: There was a significant increase in Assisting Hand Assessment, ABILHAND-Kids, Quality of Upper Extremity Skills Test, and KINDL values in the virtual reality group. Additionally, there were significant increases in the active joint range of motion of the finger flexion, wrist flexion, pronation, and supination in the virtual reality group. Conclusion: In this study, it was determined that upper extremity function, quality of life, and active joint range of motion of the children with hemiplegic cerebral palsy were increased with virtual reality-mediated upper extremity rehabilitation.

PMID: 35687751

17. Active Videogame Training Combined with Conventional Therapy Alters Body Oscillation in Children with Cerebral Palsy: A Randomized Controlled Trial
Joice Luiza Bruno Arnoni, Camila Resende Gâmbaro Lima, Bruna Nayara Verdério, Ana Francisca Rozin Kleiner, Ana Carolina de Campos, Nelci Adriana Cicuto Ferreira Rocha

Games Health J. 2022 Jun 10. doi: 10.1089/g4h.2021.0158. Online ahead of print.

Objective: Assess the effect of nonimmersive virtual reality (VR) training as complementary rehabilitation on body oscillation in children with cerebral palsy (CP) while standing on different bases of support and surfaces. Materials and Methods: Twenty-three children with unilateral CP randomly allocated to an intervention group (IG, n = 12) or control group (CG, n = 11). The IG underwent two weekly 50-minute sessions of VR training over 8 weeks, associated with conventional therapy, while the CG was submitted to two 45-minute sessions of conventional neurodevelopmental-based physiotherapy a week over the same time period. Participants were evaluated on a force platform under control conditions (CCs) (rigid surface, feet parallel); semitandem stance; flexible surface (FS) with feet parallel; and flexible surface in a semitandem (FSST) stance. The effect of the group and time factors on the center of pressure oscillation variables was analyzed by repeated-measures analysis of variance (ANOVA), with significance set at 0.05. Results: The main effect observed was for time on the FS, with a decline in the amplitude of mediolateral (ML Amp) (P = 0.01) and mediolateral root mean square (P = 0.01) after intervention. In the IG, ML Amp also declined after intervention under CCs (P = 0.02) and total velocity increased for FSST (P = 0.04). The percentage change was significant only in the IG. Conclusion: VR training as complementary rehabilitation can help improve body oscillation in children with CP and mild functional impairment. Nonimmersive VR can be considered a complementary tool for the physical rehabilitation of children with CP. This study was registered with the Brazilian Clinical Trials Registry (RBR-3zty4w).

PMID: 35687479

18. Virtual reality combined with robot-assisted gait training to improve walking ability of children with cerebral palsy: A randomized controlled trial
Wen-Sheng Fu, Bao-Ai Wu, Yi-Cun Song, Chen-Huan Qu, Jin-Feng Zhao

Technol Health Care. 2022 May 23. doi: 10.3233/THC-212821. Online ahead of print.

Background: Children with cerebral palsy (CP) have disorders of posture and movement and which can limit physical activities such as walking OBJECTIVE: This study aims to investigate the effectiveness of virtual reality (VR) combined with robot-assisted gait training (RAGT) on walking ability in children with CP and clarify the most effective degree of weight reduction. Methods: Sixty CP children were recruited and randomly allocated into four different groups. The control group received conventional physical therapy (n= 15), and task groups performed VR combined with RAGT with 15% (Group A, n= 15) /30% (Group B, n= 15) /45% (Group C, n= 15) weight loss. All participants were given 50 min of therapy per session four times a week for 12 weeks and were assessed pre-and post-test with the surface electromyography (EMG), the Modified Ashworth Scale, the Gross Motor Function Measure (GMFM) dimension E and D, and Six-Minute Walking Test (6-MWT). Results: All indicators had improved significantly in each group after the intervention (P< 0.05). The result of our study demonstrated that the more effective impacts of VR combined with RAGT on walking ability compared to the control group (P< 0.05), and 30% of weight loss had the best improvement in CP children (P< 0.01). Conclusions: VR combined RAGT can effectively improve walking ability in children with CP, especially when the weight loss is 30%.

PMID: 35661029

19. [Feedback strategies in assistive technology to promote social participation in children with cerebral palsy: Systematic review][Article in Spanish]
N Peña Novoa, M J Suarez Diaz, K Lizeth Lis Herrera, A L Sanchez Lozano

Review Rehabilitacion (Madr). 2022 May 30;S0048-7120(22)00039-1. doi: 10.1016/j.rh.2022.04.001. Online ahead of print.

Introduction: Living with cerebral palsy has consequences such as social interaction. Assistive technologies used for improving

independence only focuses on biological and physiological variables. The main objective in this review is to synthesize the evidence on interventions with assistive technologies, including feedback systems, with the aim of discovering outcomes of social participation in children with cerebral palsy. Methodology: There were 5 databases from rehabilitation which showed 683 articles in which only 9 were included. Results: The studies assessed social participation with several instruments. The majority suggested positive effects in activities such as: walking, writing, playing, and social interaction. There were tools such as electronic pencils, switches, and exoskeletons present. Conclusion: Due to the poor quality of the methodologies of these studies, the search does not establish solid conclusions. However, the evidence suggests that assistive technologies with feedback have a positive impact on aspects of social participation.

PMID: 35654627

20. Towards a multi-user experience approach to exploring key requirements to design smart habilitation devices for children with cerebral palsy
Matthew Bonello, Philip Farrugia, Nathalie Buhagiar, Joseph Mercieca

J Rehabil Assist Technol Eng. 2022 May 25;9:20556683221103164. doi: 10.1177/20556683221103164. eCollection Jan-Dec 2022.

Introduction: This paper takes a multi-stakeholder approach to generate key requirements to design smart habilitation devices for children with Cerebral Palsy. Four groups of different relevant stakeholders of smart-habilitation devices were approached to participate in this study, including children with Cerebral Palsy, their parents, occupational therapists, as well as technical specialists. Methods: Profiles of children with Cerebral Palsy were generated to have a concrete idea of their needs and desires. Meanwhile, for the three stakeholders, focus groups were used to gather their insights and requirements on a prospective smart habilitation device for children. Successively, a thematic analysis was conducted to analyse the qualitative data obtained during the focus groups. Results: Eight design requirements were developed to generate designs which stimulate high quality user experiences in children and other users of smart habilitation devices. In addition, an initial framework of the process that design engineers would follow to design such devices for children was proposed. Conclusion: Adopting this framework, and the respective requirements, will help design engineers to implement a multi-user approach and amend the design according to stakeholders' goals and desires. The resulted design should ensure a high quality user experience for both the active and potential passive users of smart habilitation devices.

PMID: 35656533

21. Temporal trends, clinical characteristics, and sociodemographic profile of post-neonatally acquired cerebral palsy in Australia, 1973-2012: A population-based observational study
Emma Waight, Sarah McIntyre, Susan Woolfenden, Linda Watson, Susan Reid, Heather Scott, Tanya Martin, Annabel Webb, Nadia Badawi, Hayley Smithers-Sheedy, Australian Cerebral Palsy Register Group

Dev Med Child Neurol. 2022 Jun 5. doi: 10.1111/dmcn.15293. Online ahead of print.

Aim: To describe post-neonatally acquired (PNN) cerebral palsy (CP) in terms of temporal trends in prevalence, clinical and sociodemographic profiles, known causes and associations between causes, and sociodemographic variables. Method: Numerator data, a count of children with PNN-CP confirmed at 5 years of age (n = 523), was drawn from two Australian state CP registers (birth years 1973-2012). Poisson regression was used to investigate temporal trends in the prevalence of PNN-CP by 5-year intervals, calculated per 10 000 live births. Using data from all state and territory Australian CP registers (n = 469), distributions of clinical characteristics, PNN-CP causes, and sociodemographic factors were tabulated (birth years 1995-2012). $\chi 2$ and logistic regression analyses were used to assess associations between sociodemographic profile, Australian reference data, and known causes. Results: A significant temporal decline in PNN-CP in Victoria ($p = 0.047$) and Western Australia ($p = 0.033$) was observed. The most common proximal causes of PNN-CP were cerebrovascular accidents (34%, n = 158), infection (25%, n = 117), and non-accidental injuries (12%, n = 58). Children born to teenage mothers, Aboriginal and/or Torres Strait Islander mothers, or children born in remote areas were over-represented in this cohort compared with reference data (all $p \leq 0.001$). Infectious causes were strongly associated with teenage motherhood (odds ratio 3.0 [95% confidence interval 1.1-8.2], $p = 0.028$) and remote living (odds ratio 4.5 [95% confidence interval 2.0-10.2], $p < 0.001$). Interpretation: Although prevalence of PNN-CP has declined, the over-representation of priority populations, and the relative severity of a condition that is largely preventable, suggest the need for more specific primary preventive measures and support.

PMID: 35665921

22. Neurodevelopment at 5 years of age for preterm-born children according to mode of conception: a cohort study
Caroline Verhaeghe, Laetitia Marchand-Martin, Monique Kaminski, Géraldine Gascoin, Laurence Foix L'hélias, Pierre-Yves Ancel, Pierre-Emmanuel Bouet, Andrei S Morgan

Am J Obstet Gynecol. 2022 Jun 4;S0002-9378(22)00437-9. doi: 10.1016/j.ajog.2022.05.062. Online ahead of print.

Background: Preterm delivery is a risk factor for sub-optimal neurodevelopment. Pregnancies conceived after medically-assisted reproduction - which includes in vitro fertilisation, with or without intracytoplasmic insemination, as well as induction of ovulation followed by intra-uterine insemination or timed intercourse - have a higher risk of preterm delivery. Few studies have evaluated the outcome at more than 2 years of age of such preterm-born children. Objective: To evaluate neurodevelopmental outcome at 5 ½ years of age of children born preterm according to the mode of conception (spontaneous versus medically-assisted reproduction). Study design: 4349 children born between 24 and 34 weeks of gestation who survived to 5 ½ years of age in the 2011 French prospective national cohort study EPIPAGE-2 were included: 814 in the medically-assisted reproduction group (433 by in vitro fertilisation, with or without intracytoplasmic insemination, and 381 by induction of ovulation) and 3535 in the spontaneously conceived group. Neurodevelopmental outcomes studied were sensory (hearing and vision) impairments, cerebral palsy, cognition and developmental coordination disorders. Multivariate analyses were performed with generalised estimating equation models adjusted for gestational age, antenatal steroids and social characteristics. All analyses were performed following multiple imputation. Sensitivity analyses were performed with the populations of singletons and cases with complete data. Results: No differences in cerebral palsy (adjusted odds ratio =1.00, 95% confidence interval 0.67-1.49), neurodevelopmental impairment (adjusted odds ratio=1.09; 95% confidence interval 0.82-1.45), or developmental coordination disorders (adjusted odds ratio=0.75; 95% confidence interval 0.50-1.12) were found between children born following medically-assisted reproduction and children born following spontaneous conception after adjustment for sociodemographic factors. For proportions of children with an intelligence quotient below one and two standard deviations, there were no differences between those born after medically-assisted reproduction or spontaneous pregnancy (respectively, adjusted odds ratio= 0.99 95% confidence interval 0.80-1.23, and adjusted odds ratio=1.14; 95% confidence interval 0.83-1.56). In subgroup analyses, no differences were seen between children born following induction of ovulation nor among those conceived through in vitro fertilisation when compared to children conceived spontaneously. Sensitivity analyses were consistent with the main results. Conclusion: In this cohort of preterm born children, there was no evidence of an impact of the mode of conception on neurodevelopmental outcomes at 5 ½ years of age.

PMID: 35671779

23. [Cerebral Palsy][Article in Japanese]
Hiroshi Arai

Nerve. 2022 Jun;74(6):771-776. doi: 10.11477/mf.1416202117.

Cerebral palsy (CP) is a relatively common neurological disease, and its prevalence at a transitional age is estimated to be approximately 0.2% in Japan. We should understand the pathology of CP, which causes various dysfunctions other than motor disturbances, for delivering a comprehensive treatment. Rapid progress in perinatal medicine has altered the underlying brain lesions. Bilateral spastic CP associated with visual cognitive impairment due to periventricular leukomalacia has becomethe most prevalent instead of dyskinetic CP due to kernicterus. New types of brain lesions found in very premature infants will be more common among adult CP in the future. Cerebellar injury causes disturbances in cognition and communication, and bilirubin encephalopathy causes severe motor impairment with marked dystonia. The latter needs various medical treatments, including botulinum toxin and intrathecal baclofen. Elevated risk of lifestyle-related and psychological diseases should also be considered.

PMID: 35676210

24. Category II Intrapartum Fetal Heart Rate Patterns Unassociated With Recognized Sentinel Events: Castles in the Air
Steven L Clark

Obstet Gynecol. 2022 Jun 1;139(6):1003-1008. doi: 10.1097/AOG.0000000000004801. Epub 2022 May 2.

The evolution of continuous electronic fetal heart rate (FHR) monitoring has presented the obstetrician with a critical clinical conundrum: basic science observations suggest that such monitoring might be associated with improved long-term neurologic outcomes, yet, after a half century of use and millions of cesarean deliveries based on FHR monitoring, evidence for such improvement remains absent. This dichotomy appears to be related to widespread misconceptions regarding the physiology underlying various FHR patterns and the developmental origins of cerebral palsy. These misconceptions are strengthened by a reliance on anecdotal experience and tradition in lieu of evidence-based medicine, the confusing "category II" FHR designation, medical-legal considerations, and our tendency to view fetal monitoring, as originally conceptualized, as a single, indivisible entity whose concepts must be accepted or rejected en bloc. Ill-defined and largely imaginary conditions such as "depletion of fetal reserve" are particularly harmful and their use in clinical medicine uniquely not evidence based. A solution to this self-inflicted injury to our specialty will require a concerted effort involving teachers, authors, and researchers.

PMID: 35675596

25. Delivering paediatric precision medicine: Genomic and environmental considerations along the causal pathway of childhood neurodevelopmental disorders

Sue Woolfenden, Michelle A Farrar, Valsamma Eapen, Anne Masi, Claire E Wakefield, Nadia Badawi, Iona Novak, Natasha Nassar, Raghu Lingam, Russell C Dale

Review Dev Med Child Neurol. 2022 Jun 6. doi: 10.1111/dmcn.15289. Online ahead of print.

Precision medicine refers to treatments that are targeted to an individual's unique characteristics. Precision medicine for neurodevelopmental disorders (such as cerebral palsy, attention-deficit/hyperactivity disorder, obsessive-compulsive disorder, Tourette syndrome, and autism spectrum disorder) in children has predominantly focused on advances in genomic sequencing technologies to increase our ability to identify single gene mutations, diagnose a multitude of rare neurodevelopmental disorders, and gain insights into pathogenesis. Although targeting specific gene variants with high penetrance will help some children with rare disease, this approach will not help most children with neurodevelopmental disorders. A 'pathway' driven approach targeting the cumulative influence of psychosocial, epigenetic, or cellular factors is likely to be more effective. To optimize the therapeutic potential of precision medicine, we present a biopsychosocial integrated framework to examine the 'gene-environment neuroscience interaction'. Such an approach would be supported through harnessing the power of big data, transdiagnostic assessment, impact and implementation evaluation, and a bench-to-bedside scientific discovery agenda with ongoing clinician and patient engagement.

PMID: 35661141

26. On Spinocerebellar Ataxia 21 as a Mimicker of Cerebral Palsy

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Neurol Genet. 2022 May 31;8(3):e668. doi: 10.1212/NXG.0000000000000668. eCollection 2022 Jun.

Objectives: Sporadic variants in ataxia genes may mimic cerebral palsy (CP). Spinocerebellar ataxia 21 (SCA21), a very rare autosomal dominant disease, was discovered to be associated with variants in the transmembrane protein 240 (TMEM240) gene in 2014. In this report, we present 2 patients with sporadic SCA21, one of them diagnosed with ataxic CP. Methods: Patients provided oral and written consent. Comprehensive clinical evaluation, neuroimaging studies, review of previous psychometric evaluations, and whole-genome sequencing were applied in both cases. Results: Both patients presented with early-onset ataxia and exhibited mild parkinsonian features. Patient 1 experienced motor and speech delay, autism, and dyslexia, whereas patient 2 experienced dyslexia. Neuroimaging was normal in both cases. In patient 1, the previously reported pathogenic c.509C>T (Pro170Leu) variant in TMEM240 was detected, whereas patient 2 harbored the novel c.182_188delinsGGAT (Val61_Pro63delinsGlyMet) variant in the same gene. Both genetic variants were sporadic. Discussion: Our findings support the notion that SCA21 is a neurodevelopmental syndrome and a mimicker of ataxic CP. Both lack of a family history of ataxia and congenital presentation were reasonable arguments to consider ataxic CP. However, lack of convincing perinatal incidents, progressive symptoms, and the common presence of cerebellar atrophy should alert neurologists about SCA21.

PMID: 35655586

27. Adverse events after different forms of botulinum neurotoxin A injections in children with cerebral palsy: An 8-year retrospective study
Jinling Li, Lu He, Hongmei Tang, Tingting Peng, Yao Long, Peishan Zeng, Yuan Huang, Zhaofang Chen, Mingshan Han, Kaishou Xu

Dev Med Child Neurol. 2022 Jun 8. doi: 10.1111/dmcn.15305. Online ahead of print.

Aim: To compare the risks of adverse events 3 months after Onabotulinumtoxin-A and Lanbotulinumtoxin-A injections in children with cerebral palsy (CP) and to identify risk factors and associations. Method: A total of 1037 children (682 males, 355 females; mean age 5 years 2 months [SD 3 years]; age range 2 years-17 years 10 months) with CP underwent 1013 Onabotulinumtoxin-A injections and 418 Lanbotulinumtoxin-A injections from 2012 to 2021. Information was recorded in a purpose-built database. Results: The adverse event rates of Onabotulinumtoxin-A and Lanbotulinumtoxin-A were reported as 13.92% and 11.96% respectively. Most adverse events were mild and self-limiting. Children in Gross Motor Function Classification System (GMFCS) levels IV to V had a higher risk of adverse events than those in GMFCS levels I to III (odds ratio [OR] [95% confidence interval {CI}] = 3.65 [1.56, 5.40], $p < 0.01$). The history of recent illness and higher dose increased the likelihood of adverse events (OR [95% CI] = 2.00 [1.55, 3.00] and 2.20 [1.53, 3.07] respectively, $p < 0.01$). Sex, age, and the number of injections had no significant effect on adverse event rates ($p > 0.05$). The incidence of upper respiratory tract infection and lower respiratory tract infection after injections was weakly correlated with the incidence before injections ($r = 0.36$ and $r = 0.27$ respectively, $p < 0.01$). Interpretation: Occurrence of adverse events was similar between Onabotulinumtoxin-A and Lanbotulinumtoxin-A in children with CP. Dose, GMFCS level, and health background were risk factors.

PMID: 35674175

28. Dystonia in individuals with spastic cerebral palsy and isolated periventricular leukomalacia
Keisuke Ueda, Bhooma R Aravamuthan, Toni S Pearson

Dev Med Child Neurol. 2022 Jun 5. doi: 10.1111/dmcn.15300. Online ahead of print.

Aim: To determine the prevalence of dystonia in individuals with periventricular leukomalacia (PVL) and spastic cerebral palsy (CP), but without basal ganglia and thalamic injury (BGTI) on brain magnetic resonance imaging (MRI). Method: This was a retrospective study of individuals with spastic CP and PVL on MRI evaluated between 2005 and 2018 in a CP center. Individuals with non-PVL brain lesions on MRI, including BGTI, were excluded. Dystonia was assessed via blinded review of neurological exam videos by pediatric movement disorders specialists. Results: Eighty-five participants (45 males, 40 females; mean age at videotaping 12 years [standard deviation 5 years 6 months], range 4-26 years) met inclusion and exclusion criteria. Of these participants, 50 (59%) displayed dystonia in their exam videos. The most common locations of dystonia were the fingers and hip adductors. The prevalence of dystonia was unaffected by the gestational age or severity of PVL, and was affected by Gross Motor Function Classification System level. Interpretation: Dystonia is common in individuals with spastic CP and PVL, even without BGTI on MRI. Our findings suggest vigilance for dystonia in individuals with spastic CP should remain high, even without MRI evidence of BGTI.

PMID: 35661146

29. Therapeutic effect of scalp-based acupuncture and moxibustion as an adjunctive treatment on children with cerebral palsy comparing to conventional rehabilitation therapy: a systematic review and meta-analysis of randomized controlled trials
Yuman Xue, Shuai Shi, Shuang Zheng, Zhongfeng Yang, Jiaben Xu, Feifei Gong

Transl Pediatr. 2022 May;11(5):631-641. doi: 10.21037/tp-22-85.

Background: Cerebral palsy (CP) in children is a predominantly congenital developmental disease with complex causes and diverse symptoms. Chinese medicine mainly uses acupuncture for the treatment of CP; as the disease site is in the brain, emphasis is placed on scalp acupuncture therapy. There were studies about the treatment but different studies had very different

results. In this study, we performed a systematic review and meta-analysis of the recent reports on scalp acupuncture in the treatment of CP in children, providing evidence for clinical diagnosis and treatment. Methods: The databases of PubMed, Chinese Biomedical Literature (CBM), China National Knowledge Infrastructure (CNKI), and VIP were searched for randomized controlled trials (RCTs) on scalp acupuncture treatment of pediatric CP published from January 2000 to December 2021. The inclusion criteria of studies were made according to the Participants, Intervention, Control, Outcomes, Study design (PICOS) principles. The Cochrane risk of bias 2.0 was used to evaluate the bias of the included literature. Meta-analysis was performed using the effective rate, Mental Development Index (MDI), Psychological Development Index (PDI), and Gross Motor Function Measure (GMFM-88 scale) as outcome indicators for the efficacy, and the safety of scalp acupuncture was assessed. Results: Initially, 332 articles were retrieved; after screening, 11 articles were included in the selection, including a total of 731 children, with 369 and 362 children for the experimental group and control group respectively. Meta-analysis showed that scalp acupuncture significantly improved the symptoms of children with CP [odds ratio (OR) =3.73, 95% confidence interval (CI): 2.49-5.58, Z=6.41, P<0.00001], could significantly improve their mental development [mean difference (MD) =15.58, 95% CI: 11.74-19.43, Z=7.95, P<0.00001] and psychological development (MD =13.23, 95% CI: 6.17-20.28, Z=3.67, P=0.0002) of children, and significantly improved the motor ability of CP children (MD =17.45, 95% CI: 8.19-26.72, Z=3.69, P=0.0002). Discussion: The curative effect of scalp acupuncture is better than that of conventional rehabilitation. Scalp-based acupuncture therapy can effectively improve the symptoms of pediatric CP, promote the mental and psychological development of children, and improve their gross motor function, the treatment is safe.

PMID: 35685079

30. Screening of differentially expressed genes in children with cerebral palsy and the construction of a network of the effective components of traditional Chinese medicine
Yueping Che, Yan Shi

Transl Pediatr. 2022 May;11(5):757-765. doi: 10.21037/tp-22-171.

Background: The study sought to construct a network of the effective components of traditional Chinese medicine (TCM) and potential therapeutic target genes of cerebral palsy based on data sets from high-throughput sequencing and the Traditional Chinese Medicine Systems Pharmacology Database and Analysis Platform (TCMSP). Methods: A transcriptome sequencing data set (GSE183021) of blood samples from children with cerebral palsy was downloaded from the Gene Expression Omnibus (GEO) database. The differentially expressed genes (DEGs) between the cerebral palsy blood samples and control blood samples were screened. The TCM active components and target genes were identified from the TCMSP. We constructed a network of the active ingredients of TCM and the cerebral palsy DEGs. Results: Using a |log2 fold change| ≥1 and a false discovery rate <0.05 as the screening criteria for the blood samples of 5 children with cerebral palsy and 5 control participants, 399 DEGs were identified. In the cerebral palsy blood samples, 209 genes were upregulated, and 190 genes were downregulated. The effective components of Angelica sinensis, Shenjincao, and Achyranthes bidentata, targeted 158 genes, and 49 genes crossed with the cerebral palsy DEGs. A network was constructed with the active ingredients of Angelica sinensis, Shenjincao, and Achyranthes bidentata and the DEGs of the cerebral palsy as nodes. Interleukin (IL)-1β, IL-6, prostaglandin-endoperoxide synthase 1, tumor necrosis factor, estrogen receptor 1, and nitric oxide synthase 2 had a wide range of effects on the effective components of Angelica sinensis, Shenjincao, and Achyranthes bidentata. Conclusions: The effective components of Angelica sinensis, Shenjincao, Achyranthes sinensis, and interact closely with the cerebral palsy DEGs. Based on the interaction network, the pharmacological mechanism of TCM in the treatment of cerebral palsy can be elucidated and new therapeutic targets discovered.

PMID: 35685065

Prevention and Cure

31. Long-term neurodevelopmental outcome in children after antenatal intravenous immune globulin treatment in fetal and neonatal alloimmune thrombocytopenia

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Am J Obstet Gynecol. 2022 Jun 4;S0002-9378(22)00438-0. doi: 10.1016/j.ajog.2022.05.063. Online ahead of print.

Background: Children with fetal and neonatal alloimmune thrombocytopenia (FNAIT) face increased risk of intracranial hemorrhage (ICH) potentially leading to developmental impairment. To prevent ICH, pregnant women with alloantibodies against fetal platelets are often treated with intravenous immunoglobulin (IVIg). IVIg appears effective in vastly reducing the risk of fetal or neonatal bleeding complications. However, information on long-term neurodevelopment of these children is lacking. Objective: To evaluate long-term neurodevelopmental outcome in children with FNAIT who were treated with IVIg antenatally. Study design: An observational cohort study was performed including children of mothers who were treated with IVIg during pregnancy because a previous child was diagnosed with FNAIT. Children, were invited for a follow-up assessment including standardized cognitive and neurologic tests. The parents were asked to complete a behavioral questionnaire and school performance reports. The primary outcome was severe neurodevelopmental impairment (NDI), defined as severe cognitive impairment (IQ < 70), cerebral palsy with Gross Motor Function Classification System (GMFCS) Level ≥ 3, bilateral blindness, and/or bilateral deafness (requiring amplification). The secondary outcome was mild to moderate NDI, defined as either mild to moderate cognitive impairment (IQ < 85), cerebral palsy with GMFCS Level ≤ 2, minor neurologic dysfunction, vision loss, and/or hearing loss. Results: Between 2003 and 2017, 51 children were liveborn after antenatal IVIg treatment. One family moved abroad and was therefore not eligible for inclusion. In total, 82% (41/50) of the eligible cases were included for neurodevelopmental assessment at a median age of 9 years and 8 months. Severe NDI was not detected. The incidence of mild to moderate NDI was 14% (6/41, 95% confidence interval: 6%-29%). The children's mean cognitive score, behavioral scores, and academic achievement were not different from the Dutch norm groups. Neuroimaging was performed in 90% (37/41) of cases. Severe ICH had been diagnosed in two cases (5%), one antenatally before the start of IVIg and the other case 1 day after birth. Both cases had a normal neurodevelopmental outcome. Conclusion: The risk of NDI in children whose mothers were treated for FNAIT with antenatal IVIg is comparable to that in the general population.

PMID: 35671780