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## Interventions and Management

### 1. Analysis of dynamic elbow flexion deformity in children with hemiplegic cerebral palsy

Elsa Povedano, Irene Gallardo-Calero, Manel Navarrete, Cristina Adillon, Jorge Knorr, Francisco Soldado

Clin Biomech (Bristol, Avon). 2020 Dec 5;81:105245. doi: 10.1016/j.clinbiomech.2020.105245. Online ahead of print.

**Background:** Cerebral palsy affects 1 per 1,000 children, and in 83% of the cases upper extremity is involved. Dynamic elbow flexion deformity is a movement disorder observed in individuals with hemiparesis secondary to cerebral palsy. We sought to determine whether children with hemiplegic cerebral palsy exhibit dynamic elbow flexion deformity during daily activities and its influence to reaching function. **Methods:** Sixteen children with upper limb hemiparesis and cerebral palsy (age 11y 7mo (SD 3y 2mo); 11 boys, 5 girls; Gross Motor Function Classification System level I or II) were included in this observational descriptive study. Manual Ability Classification System, Children's Hand-use Experience Questionnaire and Shriners Hospital for Children Upper Extremity Evaluation were used to evaluate affected upper extremity function. Spasticity was assessed with Modified Ashworth scale. Involuntary elbow flexion was recorded in eight daily activities. Elbow motion during reach function was measured. **Findings:** Fifteen out of 16 individuals showed dynamic elbow flexion deformity. There was a significant increase of involved median elbow flexion in all the activities studied, except for "high speed stairs climbing" evaluation. Children's Hand-use Experience Questionnaire showed that children were independent in most of the daily activities (21 out of 29). Correlation between dynamic elbow flexion deformity and Shriners Hospital for Children Upper Extremity Evaluation was observed only in sitting-standing activity (Spearman's  $\rho$  0.549,  $P = 0.028$ ). **Interpretation:** Dynamic elbow flexion deformity is very common in hemiplegic cerebral palsy and occurs proportionally to the degree of the effort demanded by the activities. Despite of presenting this movement disorder, it does not affect in children participation in daily activities.

PMID: [33302117](https://pubmed.ncbi.nlm.nih.gov/33302117/)

### 2. The role of hand therapy in facilitating participation in rock wall climbing: A case report of a woman with cerebral palsy

Gwen Weinstock-Zlotnick, Lorene C Janowski, Aviva Wolff

J Hand Ther. 2020 Oct 24;S0894-1130(20)30203-9. doi: 10.1016/j.jht.2020.10.013. Online ahead of print.

**Study design:** This is a case report. **Background:** A woman with hemiplegic cerebral palsy and limited right upper extremity motion, strength, and control was referred to hand therapy to enable participation in adaptive climbing. **Purpose:** The purpose of this case is to describe the role of hand therapy in identifying and addressing barriers to participation in adaptive climbing. **Description of the patient's wrist flexion/extension, grip strength, and functional use over the course of eleven months is also included.** **Methods:** Activity analysis, iterative problem solving, activity simulation, activity modification, and targeted therapeutic exercises were used over the course of eleven sessions. **Results:** The patient conveyed successful participation in

adaptive climbing with reported improvements in overall strength, motion, ability to shift weight, ability to manage digit spasticity, spontaneous right upper extremity use, and body awareness. Active right wrist flexion, wrist extension, and grip strength improved by 33 degrees, eight degrees, and 35 lbs, respectively. Conclusions: This case highlights an unconventional treatment scenario where outpatient hand therapy was entirely focused on targeting and facilitating the patient's participation in a specific activity-adaptive climbing. Rehabilitation professionals, uniquely suited to helping individuals explore interests, determine "good fit", identify barriers, and navigate obstacles, can advance the promotion of participation in activities that are both meaningful and physically engaging.

PMID: [33280981](#)

### **3. Assessment of 30-Day Adverse Events in Single-Event, Multilevel Upper Extremity Surgery in Adult Patients with Upper Motor Neuron Syndrome**

Raahil Patel, Peter C Rhee

Hand (N Y). 2020 Dec 11;1558944720975151. doi: 10.1177/1558944720975151. Online ahead of print.

Background: Upper motor neuron (UMN) syndrome consists of muscle spasticity, weakness, and dyssynergy due to a brain or spinal cord injury. The purpose of this study is to describe the perioperative adverse events for adult patients undergoing single-event, multilevel upper extremity surgery (SEMLS) due to UMN syndrome. Methods: A retrospective case series was performed for 12 consecutive adult patients who underwent SEMLS to correct upper extremity dysfunction or deformity secondary to UMN syndrome. The evaluation consisted of primary outcome measures to identify readmission rates and classify adverse events that occurred within 30 days after surgery. Results: All 12 patients were functionally dependent with 50% (n = 6) men and 50% (n = 6) women at a mean age of 43.6 years (range: 21-73) with a mean of 5.92 (range: 0-16) comorbid diagnoses at the time of surgery. There were no intraoperative complications, hospital readmissions, or deaths among the 12 patients. Five patients experienced 5 minor postoperative complications that consisted of cast- or orthosis-related skin breakdown remote from the incision (n = 3), incidental surgical site hematoma that required no surveillance or intervention (n = 1), and contact dermatitis attributed to the surgical dressing that resolved with topical corticosteroids (n = 1). Conclusions: With an appropriate multidisciplinary approach, there is minimal risk for developing perioperative and 30-day postoperative adverse events for adults undergoing SEMLS to correct upper extremity deformities secondary to UMN syndrome. Level of evidence: IV.

PMID: [33305596](#)

### **4. Hip contractures were associated with low gross motor function in children with cerebral palsy**

Inger Mechlenburg, Malene Tousgaard Foget Østergaard, Christina Bach Menzel, Kirsten Nordbye-Nielsen

Acta Paediatr. 2020 Dec 11. doi: 10.1111/apa.15717. Online ahead of print.

Aim: The aim was to identify the prevalence of hip contractures and their association with gross motor function and pain in the lower extremities among Danish children with cerebral palsy (CP). Methods: This cross-sectional study was based on data collected during regular clinical examinations in 2018-2019 and registered in the National Danish Clinical Quality Database of children with CP. The study population was 688 children (59% boys) aged five to 12 years across all Gross Motor Function Classification System (GMFCS) levels. Any associations between hip contracture and gross motor function and pain were investigated with logistic regression analysis and presented as odds ratios (OR) with 95% confidence intervals (95% CI). Results: The prevalence of hip contracture was 22% across all five GMFCS levels and the incidence varied across the five Danish regions. The odds ratios for hip contracture were significantly higher at GMFCS level IV (OR 1.99, 95% CI 1.10-3.62) and V (OR 5.49, 95% CI 3.33-9.07) compared with level I. Hip contractures were not significantly associated with pain in the lower extremities (OR 1.43, 95% CI 0.95-2.15). Conclusion: Hip contractures were frequent and associated with low gross motor function, but not lower extremity pain, in children with CP.

PMID: [33305389](#)

### **5. Physical Therapists Are Key to Hip Surveillance for Children with Cerebral Palsy: Evaluating the Effectiveness of Knowledge Translation to Support Program Implementation**

Stacey Miller, Maureen O'Donnell, Kishore Mulpuri

Phys Occup Ther Pediatr. 2020 Dec 7;1-14. doi: 10.1080/01942638.2020.1851337. Online ahead of print.

**Aims:** Physical and occupational therapists play a key role in the implementation of hip surveillance for children with cerebral palsy (CP) in British Columbia, Canada. We aimed to develop and assess a knowledge translation strategy to support the implementation of a provincial hip surveillance program. **Methods:** Pediatric therapists were invited to participate in an anonymous survey assessing hip surveillance knowledge and learning needs. Based on these results, educational materials were developed. Two years later, one year following the launch of the hip surveillance program, the survey was repeated to assess learning, knowledge use, and barriers to enrollment. **Results:** The initial survey was completed by 102 therapists; 74 therapists completed the second survey. Multifaceted educational strategies, including web-based learning, in-person education, email notifications, and print materials that targeted knowledge gaps were developed. Upon re-evaluation, knowledge increased on all questions. At follow-up, 45 therapists had enrolled a child, indicating knowledge use. Barriers to enrollment included lack of a CP diagnosis, parents or physicians not agreeing to enrollment, time requirements, and lack of space to complete the clinical exam. **Conclusions:** Targeted knowledge translation strategies were successful in meeting the educational requirements of a large group of therapists in a vast geographic area.

PMID: [33280455](#)

## 6. Effect of the Hybrid Assistive Limb on the Gait Pattern for Cerebral Palsy

Yuki Matak, Hirota Mutsuzaki, Hiroshi Kamada, Ryoko Takeuchi, Shogo Nakagawa, Kenichi Yoshikawa, Kazushi Takahashi, Mayumi Kuroda, Nobuaki Iwasaki, Masashi Yamazaki

Medicina (Kaunas). 2020 Dec 7;56(12):E673. doi: 10.3390/medicina56120673.

**Background and objectives:** Cerebral palsy (CP) is the most frequent childhood motor disability. Achieving ambulation or standing in children with CP has been a major goal of physical therapy. Recently, robot-assisted gait training using the Hybrid Assistive Limb® (HAL) has been effective in improving walking ability in patients with CP. However, previous studies have not examined in detail the changes in gait pattern after HAL training for patients with spastic CP, including gait symmetry. This study aimed to evaluate the immediate effect of HAL training on the walking ability and the changes in gait pattern and gait symmetry in patients with spastic CP. **Materials and Methods:** We recruited 19 patients with spastic CP (13 male and six female; mean age, 15.7 years). Functional ambulation was assessed using the 10-Meter Walk Test and gait analysis in the sagittal plane before and after a single 20-min HAL intervention session. **Results:** The walking speed and stride length significantly increased after HAL intervention compared to the pre-intervention values. Two-dimensional gait analysis showed improvement in equinus gait, increase in the flexion angle of the swing phase in the knee and hip joints, and improvement in gait symmetry. Immediate improvements in the walking ability and gait pattern were noted after HAL training in patients with spastic CP. **Conclusions:** The symmetry of the joint angle of the lower limb, including the trunk, accounts for the improvement in walking ability after HAL therapy.

PMID: [33297300](#)

## 7. Association of age in motor function outcomes after multilevel myofascial release in children with cerebral palsy

Chia-Hsieh Chang, Chia-Ling Chen, Kuo-Kuang Yeh, Ken N Kuo

Biomed J. 2020 Dec 3;S2319-4170(19)30503-7. doi: 10.1016/j.bj.2019.10.003. Online ahead of print.

**Background:** Many recommend deferring orthopedic surgery for cerebral palsy-related disorders in young children. However, age is correlated with musculoskeletal deterioration, and deferral may affect surgical outcomes. We aimed to clarify the relationships among age, degree of musculoskeletal disorder, and postoperative motor function change in children with cerebral palsy. **Methods:** We prospectively evaluated children with cerebral palsy and a knee flexion gait disorder who underwent multilevel myofascial release between June 2010 and July 2014. The children were divided into younger (<10 years of age) and older (>10 years of age) groups. Outcome measures included the Gross Motor Function Measure (GMFM), range of motion, spasticity, and physical capacity. Preoperative factors and postoperative changes were compared between the groups using the chi-squared, independent t-, and Mann-Whitney tests. Significant factors were plotted by participant age to identify the

relationships between age and other variables. Results: We analyzed 20 patients who underwent multilevel myofascial release (12 and 8 in the younger and older groups, respectively). Whereas most preoperative factors were comparable between the two groups, the older group had a higher range of motion limitation score (44.4 vs. 36.1,  $p < 0.05$ ). The older group also showed less improvement in the GMFM (-0.3 vs. +3.0,  $p < 0.05$ ) and physical capacity (+0 vs. +1,  $p < 0.05$ ) scores after 6 months of postoperative rehabilitation. Conclusions: Age was positively correlated with the range of motion limitation and negatively correlated with postoperative GMFM improvement. The less favored postoperative rehabilitation course in older children needs to be considered for parents whose children are amenable to surgeries.

PMID: [33281099](#)

### **8. Robotic-assisted locomotor treadmill therapy does not change gait pattern in children with cerebral palsy**

Maurizio Petrarca, Flaminia Frascarelli, Sacha Carniel, Alessandra Colazza, Silvia Minosse, Emanuela Tavernese, Enrico Castelli

Int J Rehabil Res. 2020 Dec 7. doi: 10.1097/MRR.0000000000000451. Online ahead of print.

Although robotic-assisted locomotor treadmill therapy is utilized on children with cerebral palsy (CP), its impact on the gait pattern in childhood is not fully described. We investigated the outcome of robotized gait training focusing on the gait pattern modifications and mobility in individuals with CP. An additional intention is to compare our results with the previous literature advancing future solutions. Twenty-four children with diplegic CP (average age 6.4 years old with Gross Motor Functional Classification System range I-IV) received robotized gait training five times per week for 4 weeks. Gait analysis and Gross Motor Function Measurement (GMFM) assessments were performed before and at the end of the treatment. Gait analysis showed inconsistent modifications of the gait pattern. GMFM showed a mild improvement of the dimension D in all subjects, while dimension E changed only in the younger and more severely affected patients. In this study, a detailed investigation comprehensive of electromyography patterns, where previous literature reported only sparse data without giving information on the whole gait pattern, were conducted. We carried on the analysis considering the age of the participants and the severity of the gait function. The findings differentiate the concept of specific pattern recovery (no gait pattern changes) from the concept of physical training (mild GMFM changes).

PMID: [33290305](#)

### **9. The Effects of Resistance Training on Health of Children and Adolescents With Disabilities**

Kirsten Legerlotz

Review Am J Lifestyle Med. 2018 Feb 28;14(4):382-396. doi: 10.1177/1559827618759640. eCollection Jul-Aug 2020.

Many parents still hesitate to encourage their children to participate in resistance training programs. This is unfortunate since recent research shows that resistance training can positively affect children's health. This narrative review aims to present an overview of the health-associated effects resistance training can provide particularly in children and adolescents with disabilities by describing its effects on muscle strength, physical function, mental health, self-concept, obesity, and injury prevention. To illustrate the variety of possible fields of application, the effects of resistance training in children and adolescents suffering from Charcot-Marie-Tooth disease, cerebral palsy, Down syndrome, Ehlers-Danlos syndrome, joint hypermobility, juvenile idiopathic arthritis, obesity, and spina bifida are discussed. Although randomized controlled trials with a sufficiently large sample size are rare, the research presented in this review indicates that this mode of training might be a potent tool to improve mental and physical health by improving muscle strength, body composition, self-concept or functionality, reducing pain or injury risk, and strengthening bone or tendons even in the most vulnerable groups of children with physical or mental disability. Furthermore, it has to be emphasized that compared with other types of treatment resistance training is considered to be without adverse effects.

PMID: [33281519](#)

### **10. Anthropometrical Features of Para-Footballers According to Their Cerebral Palsy Profiles and Compared to Controls**

José M Sarabia, Carmen Doménech, Enrique Roche, Néstor Vicente-Salar, Raul Reina

Int J Environ Res Public Health. 2020 Dec 4;17(23):9071. doi: 10.3390/ijerph17239071.

Cerebral palsy (CP) football is a team para-sport practiced by para-athletes with eligible impairments of hypertonia, athetosis, and ataxia. This study aimed: (1) to describe the anthropometrical and body composition profiles of international CP para-footballers with different CP profiles (i.e., spastic diplegia, athetosis/ataxia, spastic hemiplegia, and minimum impairment); (2) to analyze the differences between both affected/nondominant and nonaffected/dominant sides; and (3) to compare the sample of international-level CP para-footballers (n = 141) with a sample of highly trained able-bodied footballers (n = 39). Anthropometric measures included four breadths, nine girths, and six skinfolds, while body composition was measured through fat mass (including Carter's, Faulkner's, and Withers' equations), muscle mass (Lee's equation), and bone mass (Rocha's and Martin's equations). This study found differences between the able-bodied footballers and the following impairment profiles: spastic diplegia (skinfolds); ataxia/athetosis (corrected calf of the nondominant side, and calf skinfolds for both sides); and spastic hemiplegia (all measurements excepting femur breadth, and thigh and ankle girths). No differences were found between para-athletes with minimum impairment and the able-bodied footballers. This study demonstrates that football players with or without physical impairments of hypertonia, athetosis or ataxia may be considered homogeneous in shape when dominant size is compared. Besides, the study provides reference scores on anthropometric measures and body composition of international-level CP para-footballers that can help sports coaches and physical trainers to monitor physical fitness of their para-athletes.

PMID: [33291750](#)

### 11. Micronutrient Levels in Children with Cerebral Palsy in Abia State, Nigeria

R I Chidomere, I K Ukwabi, N K Chukwudi, N C Ojinnaka

West Afr J Med. 2020 Dec;37(7):812-818.

**Background:** Micronutrients are essential for growth and development and their deficiencies are reported in children with cerebral palsy who have attributes that predispose them to such nutrient deficiencies. There are few studies on micronutrient status of CP children in our sub-region. **Objective:** To investigate micronutrient status of children with cerebral palsy and compare values with those of controls. **Methods:** One hundred and sixty-nine children with CP and 169 controls were enrolled consecutively. Clinical features were documented using Gross Motor Functional Classification System to assess severity. Venous blood was collected for micronutrient levels measurement. Student's t test, Chi-square test and bivariate analysis were used as appropriate. Multiple linear regression was used to identify clinical antecedents of any deranged micronutrient. **Results:** The serum zinc, calcium and vitamin D levels were lower in the subjects compared with the controls ( $p < 0.001$ ). There was significant association between the serum levels of the micronutrients and age in the subjects ( $< 0.05$ ). Serum zinc level was associated with socioeconomic class in both subjects and controls ( $p < 0.001, 0.001$  respectively). Serum zinc and calcium were significantly low in 69.7% and 15.2% of subjects with feeding problems respectively. Age, gender, socioeconomic class and feeding problems had significant independent effect on serum zinc levels of the subjects. **Conclusion:** Serum levels of zinc, calcium and vitamin D are significantly low in children with CP. Age, socioeconomic class and feeding problems independently influenced the serum zinc level in the subjects. Periodic assessment of children with CP to identify those who might need specific intervention is advocated.

PMID: [33296493](#)

### 12. Biomedical Signal Acquisition Using Sensors under the Paradigm of Parallel Computing

Jesús Jaime Moreno Escobar, Oswaldo Morales Matamoros, Ricardo Tejeida Padilla, Liliana Chanona Hernández, Juan Pablo Francisco Posadas Durán, Ana Karen Pérez Martínez, Ixchel Lina Reyes, Hugo Quintana Espinosa

Sensors (Basel). 2020 Dec 7;20(23):6991. doi: 10.3390/s20236991.

There are several pathologies attacking the central nervous system and diverse therapies for each specific disease. These therapies seek as far as possible to minimize or offset the consequences caused by these types of pathologies and disorders in the patient. Therefore, comprehensive neurological care has been performed by neurorehabilitation therapies, to improve the patients' life quality and facilitating their performance in society. One way to know how the neurorehabilitation therapies

contribute to help patients is by measuring changes in their brain activity by means of electroencephalograms (EEG). EEG data -processing applications have been used in neuroscience research to be highly computing- and data-intensive. Our proposal is an integrated system of Electroencephalographic, Electrocardiographic, Bioacoustic, and Digital Image Acquisition Analysis to provide neuroscience experts with tools to estimate the efficiency of a great variety of therapies. The three main axes of this proposal are: parallel or distributed capture, filtering and adaptation of biomedical signals, and synchronization in real epochs of sampling. Thus, the present proposal underlies a general system, whose main objective is to be a wireless benchmark in the field. In this way, this proposal could acquire and give some analysis tools for biomedical signals used for measuring brain interactions when it is stimulated by an external system during therapies, for example. Therefore, this system supports extreme environmental conditions, when necessary, which broadens the spectrum of its applications. In addition, in this proposal sensors could be added or eliminated depending on the needs of the research, generating a wide range of configuration limited by the number of CPU cores, i.e., the more biosensors, the more CPU cores will be required. To validate the proposed integrated system, it is used in a Dolphin-Assisted Therapy in patients with Infantile Cerebral Palsy and Obsessive-Compulsive Disorder, as well as with a neurotypical one. Event synchronization of sample periods helped isolate the same therapy stimulus and allowed it to be analyzed by tools such as the Power Spectrum or the Fractal Geometry.

PMID: [33297388](#)

### **13. Participation patterns and determinants of participation of young children with cerebral palsy**

Sana M N Abu-Dahab, Rawan A Alheresh, Somaya H Malkawi, Maysoun Saleh, John Wong

Aust Occup Ther J. 2020 Dec 10. doi: 10.1111/1440-1630.12714. Online ahead of print.

**Introduction:** Understanding participation patterns of young children with cerebral palsy (CP) will enable occupational therapists to tailor family- and child-centred services. This study compares participation patterns and participation barriers of young children with CP with those of typically developing (TD) children. In addition, effect of age and gender on participation were examined as well as child-related determinants of participation for young children with CP. **Methods:** Participants were a convenience sample of 110 young children with CP and 150 TD children, aged 36-72 months. Children with CP represented different levels of the Gross Motor Function Classification System-Expanded and Revised (GMFCS-E&R), the Manual Ability Classification System (MACS), and the Communication Function Classification System (CFCFS). The Arabic Preschool Activity Card Sort was used to measure participation level as well as barriers of participation. T-tests, ANOVA, and exploratory regressions were employed. Significance was set at  $p < .05$ . **Results:** Young children with CP showed significant decreased overall and domain-specific participation compared to TD children ( $p < .001$ ). Perceived barriers of participation were mostly related to child-factors for young children with CP compared to greater variability in barriers in TD children. Gender had no significant effect on participation regardless of diagnosis; however, pattern of the effect of age was different among the two groups. MACS was found to be the only significant predictor of participation for children with CP ( $p = .001$ ). **Conclusion:** Occupational therapists should focus on enhancing participation for young children with CP and consider participation barriers when designing their interventions. Several factors need to be considered when aiming to enhance participation of children with CP. The use of the MACS could contribute to better intervention planning.

PMID: [33300148](#)

### **14. Exploring the after-hours social experiences of youth with disabilities in residential immersive life skills programs: a photo elicitation study**

Gillian King, Laura R Hartman, Amy C McPherson, Andrea DeFinney, Barbara Kehl, Alanna Rudzik, Andrea Morrison

Disabil Rehabil. 2020 Dec 10;1-9. doi: 10.1080/09638288.2020.1855262. Online ahead of print.

**Purpose:** This study explored the meaning of the after-hours social experiences of youth with disabilities in a residential life skills program. After-hours experiences occur outside of formal program hours, primarily in the evenings. **Method:** Five youth with cerebral palsy (three females) participated in an exploratory photo elicitation study while attending one of two residential immersive life skills programs. Following an auto-driven photo elicitation method, youth took photos of their choosing and then were interviewed about photos they elected to share. Interview data were analyzed thematically. **Results:** Themes illustrated meaningful social experiences and their benefits. Two themes described the after-hours social experiences of most importance to youth: learning about strengths from working together, and having meaningful individual and group conversations. Three themes reflected benefits reported by youth: learning about differences among people, gaining new perspectives and new knowledge about oneself, and developing friendships and a sense of "family." **Conclusions:** The findings

illuminate the benefits of after-hours social experiences for youth who may have had little opportunity previously to informally interact with other youth with disabilities. The findings highlight the importance of the immersive, group nature of a residential, away-from-home youth transition program, particularly the value added by the after-hours program component. **IMPLICATIONS FOR REHABILITATION** The findings support the value of an over-night residential aspect for life skills programs for youth with disabilities. Residential immersive life skills programs provide opportunities for youth to discuss common experiences and shared challenges, leading to the formation of social bonds. Residential immersive life skills programs provide opportunities for youth to interact with peers in the absence of adults, and to make choices about how to use their personal time. It is important to intentionally design transition programs to provide opportunities for after-hours social experiences, including working together and socializing.

PMID: [33300815](#)

### **15. Development of a new comorbidity index for adults with cerebral palsy and comparative assessment with common comorbidity indices**

Daniel G Whitney, Neil S Kamdar

Dev Med Child Neurol. 2020 Dec 2. doi: 10.1111/dmcn.14759. Online ahead of print.

**Aim:** To develop a new comorbidity index for adults with cerebral palsy (CP), the Whitney Comorbidity Index (WCI), which includes relevant comorbidities for this population and better predicts mortality than the Charlson Comorbidity Index (CCI) and Elixhauser Comorbidity Index (ECI). **Method:** Data from the Optum Clinformatics Data Mart was used for this retrospective cohort study. Diagnosis codes were used to identify adults aged 18 years or older with CP (n=1511 females, n=1511 males; mean [SD; range] age=48y [19y 2mo; 18-89y]) and all comorbidities in the year 2014. The WCI was developed based on the comorbidities of the CCI and ECI and other relevant comorbidities associated with 2-year mortality using Cox regression and competing risk analysis. The WCI was examined as unweighted (WCIunw) and weighted (WCIw). The model fit and discrimination (C-statistic) of each index was assessed using Cox regression. **Results:** Twenty-seven comorbidities were included in the WCI; seven new comorbidities that were not part of the CCI or ECI were added. The WCIunw and WCIw showed a better model fit and discrimination for 1- and 2-year mortality compared to the CCI and ECI. The WCIunw and WCIw were strong predictors for 1- and 2-year mortality (C-statistic [95% confidence interval] ranging from 0.81 [0.76-0.85] to 0.88 [0.82-0.94]). **Interpretation:** The new WCI, designed to include clinically relevant comorbidities, provides a better model fit and discrimination of mortality for adults with CP.

PMID: [33289071](#)

### **16. Intrauterine cytomegalovirus infection: a possible risk for cerebral palsy and related to its clinical features, neuroimaging findings: a retrospective study**

H Xu, L Zhang, X Y Xuan, M Zhu, J Tang, X K Zhao

BMC Pediatr. 2020 Dec 8;20(1):555. doi: 10.1186/s12887-020-02449-3.

**Background:** Abundant clinical evidences indicate that the increased risk of cerebral palsy (CP) may be associated with the intrauterine exposure to maternal infection. Cytomegalovirus (CMV) is a common cause of CP. However, little is known about the relationship between the intrauterine exposure of the fetus to CMV infection and CP. This study aims to explore the relationships between intrauterine CMV infection and clinical symptoms, classification, intelligence development and brain neuroimaging findings in children with CP. **Methods:** In this study, 147 children with CP in recent 6 years were retrospectively analyzed (average age:  $14.76 \pm 3.07$  months; sex (M/F): 103/44). 148 children had CMV IgG and IgM positive sera identified by TORCH examination were selected as the control group (average age:  $15.10 \pm 3.21$  months; sex (M/F): 102/46), which also undergo the examination of CMV-DNA in urine. The age and sex of children in the control group were matched with those in the CP group. CMV-DNA in urine was detected by CMV fluorescence quantitative PCR, and t-test was performed to analyze the number of copies. For the CP group, standardized rehabilitation treatment was performed and the function of gross motor was evaluated by GMFM scale before and after treatment. The Gesell developmental scale (GDS) was used to assess the level of intellectual development. The classification of CP was conducted and the results of magnetic resonance imaging were analyzed. Finally, the correlations between the copy number of CMV-DNA and the clinical characteristics of children with CP were evaluated by the method of Pearson and Spearman correlation analysis. **Results:** The level of CMV infection was negatively correlated with the developmental quotient (DQ) of children with CP. Negative association was found between the level of CMV infection and the level of the gross motor development. The level of CMV infection was positively related with

the occurrence probability of spastic quadriplegia. However, no associations were found between the abnormalities of brain tissue and the number of CMV copies. Moreover, CMV infection might add the difficulty of the rehabilitation treatment. Conclusions: CMV infection is a risk factor for the occurrence of CP in children. Pregnancy examination should be strengthened. Early detection and control of CMV infection may contribute to the rehabilitation of children with CP and reduce the disability and social burden.

PMID: [33292171](#)

### **17. Perinatal Brain Injury and Inflammation: Lessons from Experimental Murine Models**

Aisling Leavy, Eva M Jimenez Mateos

Review Cells. 2020 Dec 8;9(12):E2640. doi: 10.3390/cells9122640.

Perinatal brain injury or neonatal encephalopathy (NE) is a state of disturbed neurological function in neonates, caused by a number of different aetiologies. The most prominent cause of NE is hypoxic ischaemic encephalopathy, which can often induce seizures. NE and neonatal seizures are both associated with poor neurological outcomes, resulting in conditions such as cerebral palsy, epilepsy, autism, schizophrenia and intellectual disability. The current treatment strategies for NE and neonatal seizures have suboptimal success in effectively treating neonates. Therapeutic hypothermia is currently used to treat NE and has been shown to reduce morbidity and has neuroprotective effects. However, its success varies between developed and developing countries, most likely as a result of lack of sufficient resources. The first-line pharmacological treatment for NE is phenobarbital, followed by phenytoin, fosphenytoin and lidocaine as second-line treatments. While these drugs are mostly effective at halting seizure activity, they are associated with long-lasting adverse neurological effects on development. Over the last years, inflammation has been recognized as a trigger of NE and seizures, and evidence has indicated that this inflammation plays a role in the long-term neuronal damage experienced by survivors. Researchers are therefore investigating the possible neuroprotective effects that could be achieved by using anti-inflammatory drugs in the treatment of NE. In this review we will highlight the current knowledge of the inflammatory response after perinatal brain injury and what we can learn from animal models.

PMID: [33302543](#)

### **18. Recent Advances in the Diagnosis and Treatment of Neonatal Seizures**

Debopam Samanta

Neuropediatrics. 2020 Dec 8. doi: 10.1055/s-0040-1721702. Online ahead of print.

Seizures are the most common neurological emergency in the neonates, and this age group has the highest incidence of seizures compared with any other period of life. The author provides a narrative review of recent advances in the genetics of neonatal epilepsies, new neonatal seizure classification system, diagnostics, and treatment of neonatal seizures based on a comprehensive literature review (MEDLINE using PubMed and OvidSP vendors with appropriate keywords to incorporate recent evidence), personal practice, and experience. Knowledge regarding various systemic and postzygotic genetic mutations responsible for neonatal epilepsy has been exploded in recent times, as well as better delineation of clinical phenotypes associated with rare neonatal epilepsies. An International League Against Epilepsy task force on neonatal seizure has proposed a new neonatal seizure classification system and also evaluated the specificity of semiological features related to particular etiology. Although continuous video electroencephalogram (EEG) is the gold standard for monitoring neonatal seizures, amplitude-integrated EEGs have gained significant popularity in resource-limited settings. There is tremendous progress in the automated seizure detection algorithm, including the availability of a fully convolutional neural network using artificial machine learning (deep learning). There is a substantial need for ongoing research and clinical trials to understand optimal medication selection (first line, second line, and third line) for neonatal seizures, treatment duration of antiepileptic drugs after cessation of seizures, and strategies to improve neuromorbidities such as cerebral palsy, epilepsy, and developmental impairments. Although in recent times, levetiracetam use has been significantly increased for neonatal seizures, a multicenter, randomized, blinded, controlled phase IIb trial confirmed the superiority of phenobarbital over levetiracetam in the acute suppression of neonatal seizures. While there is no single best choice available for the management of neonatal seizures, institutional guidelines should be formed based on a consensus of local experts to mitigate wide variability in the treatment and to facilitate early diagnosis and treatment.

PMID: [33291160](#)

### 19. The somatosensory cortical activity in individuals with cerebral palsy displays an aberrant developmental trajectory

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Individuals with cerebral palsy (CP) have a reduced somatosensory cortical response -Somatosensory cortical response strength decreases from adolescence to early adulthood -Somatosensory cortical responses in youth with CP are similar to adult controls -Individuals with CP may have aberrant maturation of the somatosensory system ABSTRACT: Numerous studies have documented tactile and proprioceptive deficits in children with cerebral palsy (CP) and linked these with weaker somatosensory cortical activity. However, whether such aberrations in somatosensory processing extend and/or progress into adulthood remains poorly understood. In the current study, we used magnetoencephalography (MEG) to investigate the primary somatosensory responses in a sample of individuals with CP (N = 42; Age = 9 - 28 years) and a cohort of healthy controls (N = 23; Age range = 11 - 23 years). Briefly, transient electrical stimulation was applied to the right tibial nerve, and standardized low-resolution brain electromagnetic tomography (sLORETA) was used to image the dynamic somatosensory cortical response. We found that the strength of somatosensory cortical activity within the 112 - 252 ms time window was significantly reduced in the individuals with CP compared with the healthy controls (HC =  $286.53 \pm 30.51$ , 95% CI [226.74, 346.32]; CP =  $208.30 \pm 19.66$ , CI [169.77, 246.83], P = 0.0126). These results corroborate previous findings of aberrant somatosensory cortical activity in individuals with CP. Our results also suggest that the somatosensory cortical activity tends to become weaker with age, with a similar rate of neurophysiological change in individuals with CP and healthy controls (P = 0.8790). Visualization of regression models fit to the data imply that youth with CP may have somatosensory cortical activity similar to adult controls. These findings suggest that some individuals with CP exhibit an aberrant developmental trajectory of their somatosensory system. This article is protected by copyright. All rights reserved.

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### 20. Monogenic Causes of Dystonic Syndromes: Common in Dystonic Cerebral Palsy, Rare in Isolated Dystonia

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### 21. Effect of Early Targeted Treatment of Ductus Arteriosus with Ibuprofen on Survival Without Cerebral Palsy at 2 years in Infants with Extreme Prematurity: A Randomized Clinical Trial

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Objective: To examine the effects of early echocardiography-targeted ibuprofen treatment of large patent ductus arteriosus (PDA) on survival without cerebral palsy (CP) at 24 months corrected age. Study design: We enrolled infants born at <28 weeks of gestation with a large PDA on echocardiography at 6-12 hours after birth to ibuprofen or placebo by 12 hours of age in a multicenter, double blind, randomized-controlled trial. Open-label ibuprofen was allowed for prespecified criteria of a hemodynamically significant PDA. The primary outcome was survival without CP at 24 months corrected age. Results: Among 337 enrolled infants, 109 had a small or closed ductus and constituted a reference group; 228 had a large PDA and were randomized. The primary outcome was assessed at 2 years in 108/114 (94.7%) and 102/114 (89.5%) patients allocated to ibuprofen or placebo, respectively. Survival without CP occurred in 77/108 (71.3%) after ibuprofen, 73/102 (71.6%) after placebo (adjusted relative risk (aRR), 0.98, 95% confidence interval (CI) 0.83 to 1.16, P=.83), and 77/101 (76.2%) in reference group. Ibuprofen-treated infants had a lower incidence of PDA at day 3. Severe pulmonary hemorrhage during the first 3 days occurred in 2/114 (1.8%) ibuprofen and 9/114 (7.9%) placebo-treated infants (aRR, 0.22, 95% CI, 0.05 to 1.00, P=.05). Open-label rescue treatment with ibuprofen occurred in 62.3% placebo and 17.5% ibuprofen-treated infants (P<.001), at a median

(IQR) age of 4 (3,5) and 4 (4,12) days, respectively. Conclusion: Early echocardiography-targeted ibuprofen treatment of a large PDA did not change the rate of survival without CP.

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