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**Professor Nadia Badawi AM**  
CP Alliance Chair of Cerebral Palsy Research

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## Interventions and Management

### 1. Detecting Movement Changes in Children with Hemiparesis after Upper Limb Therapies: A Responsiveness Analysis of a 3D Bimanual Protocol

Marine Cacioppo, Mathieu Lempereur, Laetitia Houx, Sandra Bouvier, Rodolphe Bailly, Sylvain Brochard

Sensors (Basel). 2023 Apr 24;23(9):4235. doi: 10.3390/s23094235.

The "Be an Airplane Pilot" (BE API) protocol was developed to evaluate upper limb (UL) kinematics in children with unilateral cerebral palsy (uCP) during bimanual tasks. The aim of this study was to investigate the responsiveness of this protocol to changes in kinematics and movement quality after UL therapies, using individual and group analyses, and to analyse the relationships between kinematic and functional changes in these children. Twenty children with uCP (5-15 years old) either participated in bimanual intensive therapy or received UL botulinum toxin injections. All the children performed the BE API protocol and functional assessments (Assisting Hand Assessment [AHA]) before and after the interventions. The individual analyses found kinematic changes in 100% of the children after therapy. The group analysis found significantly higher trunk and shoulder deviations after the intensive therapy. No significant changes were found for smoothness or trajectory straightness. The changes in the kinematic deviations were moderately correlated with the changes in the AHA scores. This study confirmed the responsiveness of the BE API protocol to change after therapy; therefore, the protocol is now fully validated and can be implemented in clinical practice. Its use should help in the accurate identification of impairments so that individualized treatments can be proposed.

PMID: [37177439](https://pubmed.ncbi.nlm.nih.gov/37177439/)

### 2. Brain Stimulation and Constraint Induced Movement Therapy in Children With Unilateral Cerebral Palsy: A Randomized Controlled Trial

Juhi Gupta, Sheffali Gulati, Upinder Pal Singh, Atin Kumar, Prashant Jauhari, Biswaroop Chakrabarty, Ravindra Mohan Pandey, Renu Bhatia, Suman Jain, Achal Srivastava

Neurorehabil Neural Repair. 2023 May 11;15459683231174222. doi: 10.1177/15459683231174222. Online ahead of print.

Background: There is a crucial need to devise optimum rehabilitation programs for children with cerebral palsy (CP). Objective: This study aimed to assess the feasibility, safety, and efficacy of combining 6-Hz primed, low-frequency, repetitive transcranial magnetic stimulation (rTMS) with modified constraint-induced movement therapy (mCIMT) in improving upper limb function in children with unilateral CP. Methods: Children aged 5 to 18 years with unilateral CP were randomized (23 in each arm) to receive 10 sessions of mCIMT with real rTMS (intervention arm) or mCIMT with sham rTMS (control arm), on alternate weekdays over 4 weeks. The primary outcome was the difference in mean change in Quality of Upper Extremity Skills Test (QUEST) scores. Secondary outcomes were changes in QUEST domain scores, speed and strength measures, CP quality of life (CP-QOL) scale scores, and safety of rTMS. Results: All 46 children completed the trial except one. At 4 weeks, the mean change in total QUEST scores was significantly higher in the intervention arm as compared to the control arm ( $11.66 \pm 6.97$  vs  $6.56 \pm 4.3$ ,  $d = 5.1$ , 95% CI 1.7-8.5,  $P = .004$ ). Change in "weight bearing" and "protective extension" domain score was significantly higher for children in the intervention arm. These improvements were sustained at 12 weeks ( $P$

= .028). CP-QOL scores improved at 12 weeks. No serious adverse events were seen. Conclusion: A 6-Hz primed rTMS combined with mCIMT is safe, feasible, and superior to mCIMT alone in improving the upper limb function of children with unilateral CP.

PMID: [37170480](#)

### 3. Total Wrist Arthrodesis: An Update on Indications, Technique and Outcomes

E Carlos Rodriguez-Merchan, Eloy D Tabeayo-Alvarez, Babak Shojaie, Amir R Kachooei

Review Arch Bone Jt Surg. 2023;11(3):144-153. doi: 10.22038/ABJS.2022.65875.3154.

Painful end-stage wrist osteoarthritis (OA) unresponsive to conservative treatment is frequently managed with total wrist arthrodesis (TWA), which might render pain alleviation and ameliorate function, pain, and grip strength. Usual indications for TWA include inflammatory arthritis, idiopathic degenerative OA and posttraumatic OA, Kienböck's illness, brachial plexus palsy, cerebral paralysis, infraclavicular brachial plexus blocks and other spastic and contracture base illnesses, scapholunate advanced collapse, scaphoid nonunion advanced collapse, and failure of other surgical techniques such as after failed total wrist arthroplasty, four-corner fusion, proximal row carpectomy and severe ligament injuries (this procedure is carried out when all other treatment alternatives have failed to control the individual's symptoms). TWA is commonly carried out with a dorsal plate fixed from the distal radius to the third metacarpal. However, other surgical procedures have been reported, including intramedullary fixation and new implants that do not cross the third carpometacarpal joint or some procedures without utilizing hardware for example using a vascularized fibular grafting In individuals with rheumatoid arthritis. TWA has been shown to give persistent and painless stability for 20 years or more. The rate of adverse events for TWA ranges from 0.1% to 6.1%, though some authors have published that it can be as high as 27%. The most common adverse events are tendon ruptures, peri-implant fractures of the third metacarpal, the need for hardware removal, and constant pain at the third carpometacarpal joint. In idiopathic degenerative OA, the reoperation rate following TWA has been reported as high as 63%. While TWA can render foreseeable pain alleviation and ameliorate function, orthopedic surgeons should remember that this surgical technique is not without its risks and that the accessibility of many surgical procedures requires orthopedic surgeons to scrupulously contemplate the risks and benefits of each alternative for the individual in front of them.

PMID: [37168590](#)

### 4. A protocol for a single-arm interventional study assessing the effects of a home-based joystick-operated ride-on-toy navigation training programme to improve affected upper extremity function and spontaneous use in children with unilateral cerebral palsy (UCP)

Vaishnavi Shahane, Patrick Kumavor, Kristin Morgan, Kathleen M Friel, Sudha Madhav Srinivasan

BMJ Open. 2023 May 9;13(5):e071742. doi: 10.1136/bmjopen-2023-071742.

Introduction: Children with unilateral cerebral palsy (UCP) face significant limitations in upper extremity (UE) function and require effective interventions that promote intensive goal-directed practice while maximising motivation and adherence with therapy. This study builds on our past work and will assess the effects of a 6-week researcher-caregiver codelivered, home-based ride-on-toy navigation training (RNT) programme in young children with UCP. We hypothesise that the RNT programme will be acceptable, feasible to implement, and lead to greater improvements in unimanual and bimanual function when combined with conventional therapy, compared with conventional therapy provided alone. Methods and analysis: 15 children with UCP between 3 and 8 years will be recruited. During the 6-week control phase, participants will receive treatment-as-usual alone. During the subsequent 6-week intervention phase, in addition to conventional therapy, RNT will be provided 4-5 times/week (2 times by researchers, 2-3 times by caregivers), 30-45 min/session. We will assess UE function using standardised tests (Quality of Upper Extremity Skills Test and Shriner's Hospital Upper Extremity Evaluation), reaching kinematics, wrist-worn accelerometry, caregiver-rated ABILHAND-Kids questionnaire, and training-specific measures of movement control during RNT. Programme feasibility and acceptance will be assessed using device use metrics, child and caregiver exit questionnaires, training-specific measures of child engagement, and the Physical Activity Enjoyment Scale. All assessments will be conducted at pretest, following the control phase (midpoint), and after completion of the intervention phase (post-test). Ethics and dissemination: The study is approved by the Institutional Review Board of the University of Connecticut (# H22-0059). Results from this study will be disseminated through peer-reviewed manuscripts in scientific journals in the field, through national and international conferences, and through presentations to parent advocacy groups and other support organisations associated with CP.

PMID: [37160396](#)

### 5. Autofusion With Magnetically Controlled Growing Rods: A Case Report

Michael J Yang, Alexander Rompala, Solomon Praveen Samuel, Amer Samdani, Joshua Pahys, Steven Hwang

Case Reports Cureus. 2023 Mar 24;15(3):e36638. doi: 10.7759/cureus.36638. eCollection 2023 Mar.

Magnetically controlled growing rods (MCGRs) are an effective alternative to traditional growing rods (TGRs) in the treatment of early-onset scoliosis (EOS), with comparable deformity correction despite fewer planned reoperations. This case report presents a unique case of autofusion in a patient with tetraplegic cerebral palsy, thoracic myelomeningocele, and EOS who was treated with dual MCGR instrumentation and underwent serial lengthening procedures for four years. We detail the operative and radiographic findings in a novel case of autofusion encountered after MCGR placement to treat EOS. An eight-year-old female with tetraplegic cerebral palsy causing a 94° right thoracic neuromuscular scoliosis was treated with dual MCGRs; she then underwent serial lengthenings every four months. At 12 years of age, during MCGR explantation and posterior spinal fusion, dense heterotopic autofusion was encountered around the MCGR instrumentation, limiting further deformity correction. The benefits of MCGRs make them an appealing alternative to TGRs for the treatment of EOS. Although the theoretical risk of autofusion in MCGRs is low, recent case reports propose autofusion as a possible reason for MCGRs' failure to lengthen.

PMID: [37155436](#)

## 6. Treatment of Hip Dislocation in Cerebral Palsy with Extraarticular Intervention

I A Sarikaya, S E Birsal, O A Erdal, B Görgün, A Şeker, M İnan

Acta Chir Orthop Traumatol Cech. 2023;90(2):92-99.

**PURPOSE OF THE STUDY** Hip dislocation is one of the major causes of disability in children with cerebral palsy (CP). Surgical treatment can be achieved using different techniques including proximal femoral varus derotation osteotomy (FVDRO), pelvic osteotomies, and open hip reduction (OHR). However, we claim that pathologies originating from extraarticular structures in the dislocated hip in CP can be reconstructed by extraarticular methods and OHR may not always be necessary. Therefore, this study aims to discuss the results of hip reconstruction with extraarticular intervention in patients with CP. **MATERIAL AND METHODS** In total, 141 hips (95 patients) were included in the study. All patients underwent FVDRO, either with or without a Dega osteotomy. Changes in the Acetabular Index (AI), Migration Index (MI), neck-shaft angle (NSA), and center-edge angle (CEA) were assessed on the preoperative, postoperative, and final follow-up anterior-posterior radiographs of the pelvis. **RESULTS** Median age was 8 years (range between 4-18 years). The average follow-up duration was 5 years (range between 2-9 years). Changes in AI, MI, NSA and CEA values were statistically significant for postop and follow-up periods when compared to preoperative values. Of the 141 operated hips, 8 (5.6%) hips required revision surgery due to redislocation/resubluxation detected at the follow-ups, and unilateral operation can be accepted as a risk factor for redislocation. **CONCLUSIONS** Our results demonstrate that reconstructive treatment consisting of FVDRO, medial capsulotomy (in the case of reduction difficulty) and transiliac osteotomy (in the case of acetabular dysplasia) provides satisfactory outcomes in hip dislocation in CP. **Key words:** hip displacement, cerebral palsy, hip reduction.

PMID: [37155997](#)

## 7. Wearable accelerometers for measuring and monitoring the motor behaviour of infants with brain damage during CareToy-Revised training

Mattia Franchi De' Cavalieri, Silvia Filogna, Giada Martini, Elena Beani, Martina Maselli, Matteo Cianchetti, Nevio Dubbini, Giovanni Cioni, Giuseppina Sgandurra; CareToy-R Consortium

J Neuroeng Rehabil. 2023 May 6;20(1):62. doi: 10.1186/s12984-023-01182-z.

**Background:** Nowadays, wearable sensors are widely used to quantify physical and motor activity during daily life, and they also represent innovative solutions for healthcare. In the clinical framework, the assessment of motor behaviour is entrusted to clinical scales, but they are dependent on operator experience. Thanks to their intrinsic objectivity, sensor data are extremely useful to provide support to clinicians. Moreover, wearable sensors are user-friendly and compliant to be used in an ecological environment (i.e., at home). This paper aims to propose an innovative approach useful to predict clinical assessment scores of infants' motor activity. **Materials and methods:** Starting from data acquired by accelerometers placed on infants' wrists and trunk during playtime, we exploit the method of functional data analysis to implement new models combining quantitative data and clinical scales. In particular, acceleration data, transformed into activity indexes and combined with baseline clinical data, represent the input dataset for functional linear models. **Conclusions:** Despite the small number of data samples available, results show correlation between clinical outcome and quantitative predictors, indicating that functional linear models could be able to predict the clinical evaluation. Future works will focus on a more refined and robust application of the proposed method, based on the acquisition of more data for validating the presented models.

PMID: [37149595](#)

## 8. Rehabilitation of Gait and Balance in Cerebral Palsy: A Scoping Review on the Use of Robotics with Biomechanical Implications

Mirjam Bonanno, Angela Mili, Francesca La Fauci Belponer, Rosaria De Luca, Danilo Leonetti, Angelo Quartarone, Irene Ciancarelli, Giovanni Morone, Rocco Salvatore Calabrò

Review J Clin Med. 2023 May 4;12(9):3278. doi: 10.3390/jcm12093278.

Cerebral palsy (CP) is a congenital and permanent neurological disorder due to non-progressive brain damage that affects gross motor functions, such as balance, trunk control and gait. CP gross motor impairments yield more challenging right foot placement during gait phases, as well as the correct direction of the whole-body center of mass with a stability reduction and an increase in falling and tripping. For these reasons, robotic devices, thanks to their biomechanical features, can adapt easily to CP children, allowing better motor recovery and enjoyment. In fact, physiotherapists should consider each pathological gait feature to provide the patient with the best possible rehabilitation strategy and reduce extra energy efforts and the risk of falling in children affected by CP.

PMID: [37176718](#)

## 9. Using Neonatal Magnetic Resonance Imaging to Predict Gross Motor Disability at Four Years in Term-Born Children With Neonatal Encephalopathy

Hannah Lambing, Dawn Gano, Yi Li, Ashley M Bach, Olivia Girvan, Elizabeth E Rogers, Donna M Ferriero, A James Barkovich, Duan Xu, Charles E McCulloch, Hannah C Glass

Pediatr Neurol. 2023 Mar 24;144:50-55. doi: 10.1016/j.pediatrneurol.2023.03.011. Online ahead of print.

Background: Children with neonatal encephalopathy (NE) are at risk for basal ganglia/thalamus (BG/T) and watershed patterns of brain injury. Children with BG/T injury are at high risk for motor impairment in infancy, but the predictive validity of a published rating scale for outcome at age four years is not known. We examined a cohort of children with NE and magnetic resonance imaging (MRI) to examine the relationship between BG/T injury and severity of cerebral palsy (CP) in childhood. Methods: Term-born neonates at risk for brain injury due to NE were enrolled from 1993 to 2014 and received MRI within two weeks of birth. Brain injury was scored by a pediatric neuroradiologist. The Gross Motor Function Classification System (GMFCS) level was determined at four years. The relationship between BG/T injury and dichotomized GMFCS (no CP or GMFCS I to II = none/mild versus III to V = moderate/severe CP) was evaluated with logistic regression, and predictive performance was assessed by cross-validated area under the receiver operating characteristic curve (AUROC). Results: Among 174 children, higher BG/T scores were associated with more severe GMFCS level. Clinical predictors had a low AUROC (0.599), compared with that of MRI (0.895). Risk of moderate to severe CP was low (<20%) in all patterns of brain injury except BG/T = 4, which carried a 67% probability (95% confidence interval 36% to 98%) of moderate to severe CP. Conclusions: The BG/T injury score can be used to predict the risk and severity of CP at age four years and thereby inform early developmental interventions.

PMID: [37148603](#)

## 10. "It is something that gives us hope": Lived experience among parents to children with cerebral palsy who are non-ambulant of the phenomenon physical activity, with or without the use of a novel dynamic standing device

Katarina Lauruschkus, Robert Holmberg, Åsa B Tornberg

Front Rehabil Sci. 2023 Apr 24;4:1139847. doi: 10.3389/fresc.2023.1139847. eCollection 2023.

Introduction: Regular physical activity confers health benefits for all. Parents commonly want their children to be physically active, and want to be physically active themselves, but children with cerebral palsy (CP) who are non-ambulant face challenges, and they need support to be physically active. Dynamic standing in the novel motorized assistive device Innwalk has positive effects in children who are non-ambulant-it gives them a chance to be physically active. The aim of this study was to explore the lived experience of physical activity of parents themselves and for their children with cerebral palsy who are non-ambulant. Methods: A descriptive inductive design with a hermeneutic phenomenological approach was used for the analysis of interviews with 11 parents of children with CP who are non-ambulant who participated in a study of exercise effects of dynamic standing. Results: The parents experienced physical activity for their children as being important but difficult, especially for their child, as described in Theme 1: "Being aware of health benefits while struggling with family time." The children were perceived as being dependent on other people, the environment, and equipment for participating in physical activity, referring to Theme 2: "Being dependent." The opportunity for their children to become physically active on a regular basis through an assistive device gave the parents hope for a better life, which formed Theme 3: "Getting hope in a challenging life situation." Conclusion: Physical activity for children with CP who are non-ambulant is possible through an elaborate network of social relations and environmental conditions. Limiting the degree of dependence and containing the negative consequences of high a degree of dependence are vital in the support of physical activity. Relations, support, and assistive

devices that strengthen empowerment and autonomy should be prioritized, and if this works, the experience of physical activity can be positive, giving families hope.

PMID: [37168233](#)

### **11. "It's like a guessing game all the time": parent insights on barriers, supports, and priorities for children with cortical visual impairment and complex communication needs**

Tara V McCarty, Janice C Light

Augment Altern Commun. 2023 May 9;1-14. doi: 10.1080/07434618.2023.2206904. Online ahead of print.

Parents of children with both cortical visual impairment (CVI) and complex communication needs offer unique perspectives on their children's journeys to receiving proper diagnoses, supports, and interventions, such as augmentative and alternative communication (AAC). This study explored the lived experiences, supports, and barriers identified by parents through a qualitative phenomenological approach. Nine parents of children with both CVI and complex communication needs were interviewed virtually. Results indicated five themes descriptive of the parents' experiences: Challenges Piecing Together a CVI Diagnosis; Dealing with Low Expectations of Others; Parents Empowered to Take Action; Guessing Game to Determine Appropriate AAC to Accommodate CVI; and Aligning Professional Practice with Parent Priorities. Whereas some of these themes echoed the experiences of parents of children with complex communication needs (such as those with cerebral palsy) who were not specifically diagnosed with CVI, other themes were unique to this set of parents including the uncertainty of AAC design and intervention given the challenges of CVI and the necessity of more than one way for children to communicate given their visual challenges. This study highlighted the dire need for continued investigation to determine effective AAC interventions for individuals with CVI.

PMID: [37158794](#)

### **12. Pain and labor outcomes: A longitudinal study of adults with cerebral palsy in Sweden**

Derek Asuman, Ulf-G Gerdtam, Ann I Alriksson-Schmidt, Elisabet Rodby-Bousquet, Guro L Andersen, Johan Jarl

Disabil Health J. 2023 Apr 18;101479. doi: 10.1016/j.dhjo.2023.101479. Online ahead of print.

Background: Pain is a global health concern with substantial societal costs and limits the activity participation of individuals. The prevalence of pain is estimated to be high among individuals with cerebral palsy (CP). Objectives: To estimate the association between pain and labor outcomes for adults with CP in Sweden. Methods: A longitudinal cohort study based on data from Swedish population-based administrative registers of 6899 individuals (53,657 person-years) with CP aged 20-64 years. Individual fixed effects regression models were used to analyze the association between pain and labor outcomes (employment and earnings from employment), as well as potential pathways through which pain might affect employment and earnings. Results: Pain was associated with adverse outcomes varying across severity, corresponding to a reduction of 7-12% in employment and 2-8% in earnings if employed. Pain might affect employment and earnings through increased likelihood of both sickness leave and early retirement. Conclusion: Pain management could potentially be important to improve labor outcomes for adults with CP, in addition to improving the quality of life.

PMID: [37149449](#)

### **13. Reconnecting the Hand and Arm to the Brain: Efficacy of Neural Interfaces for Sensorimotor Restoration after Tetraplegia**

Eric Z Herring, Emily L Graczyk, William D Memberg, Robert D Adams, Guadalupe Fernandez Baca-Vaca, Brianna C Hutchison, John T Krall, Benjamin J Alexander, Emily C Conlan, Kenya E Alfaro, Preethi R Bhat, Aaron B Ketting-Olivier, Chase A Haddix, Dawn M Taylor, Dustin J Tyler, Robert F Kirsch, A Bolu Ajiboye, Jonathan P Miller

medRxiv. 2023 Apr 26;2023.04.24.23288977. doi: 10.1101/2023.04.24.23288977. Preprint

Background: Paralysis after spinal cord injury involves damage to pathways that connect neurons in the brain to peripheral nerves in the limbs. Re-establishing this communication using neural interfaces has the potential to bridge the gap and restore upper extremity function to people with high tetraplegia. Objective: We report a novel approach for restoring upper extremity function using selective peripheral nerve stimulation controlled by intracortical microelectrode recordings from sensorimotor networks, along with restoration of tactile sensation of the hand using intracortical microstimulation. Methods: A right-handed man with motor-complete C3-C4 tetraplegia was enrolled into the clinical trial. Six 64-channel intracortical microelectrode arrays were implanted into left hemisphere regions involved in upper extremity function, including primary motor and sensory cortices, inferior frontal gyrus, and anterior intraparietal area. Nine 16-channel extraneural peripheral nerve electrodes were implanted to allow targeted stimulation of right median, ulnar (2), radial, axillary, musculocutaneous, suprascapular, lateral



pectoral, and long thoracic nerves, to produce selective muscle contractions on demand. Proof-of-concept studies were performed to demonstrate feasibility of a bidirectional brain-machine interface to restore function of the participant's own arm and hand. Results: Multi-unit neural activity that correlated with intended motor action was successfully recorded from intracortical arrays. Microstimulation of electrodes in somatosensory cortex produced repeatable sensory percepts of individual fingers for restoration of touch sensation. Selective electrical activation of peripheral nerves produced antigravity muscle contractions. The system was well tolerated with no operative complications. Conclusion: The combination of implanted cortical electrodes and nerve cuff electrodes has the potential to allow restoration of motor and sensory functions of the arm and hand after neurological injury.

PMID: [37162904](#)

#### **14. Leaving no one behind: Cerebral palsy in indigenous populations**

Sally Ann Lynch

Dev Med Child Neurol. 2023 May 8. doi: 10.1111/dmcn.15624. Online ahead of print.

No abstract available

PMID: [37157230](#)

#### **15. Acceptability of a progressive resistance training programme for ambulatory adolescents with spastic cerebral palsy in England: a qualitative study**

Jennifer M Ryan, Cherry Kilbrid, Marika Noorkoiv, Nicola Theis, Adam Shortland, Wendy Levin, Grace Lavelle

Disabil Rehabil. 2023 May 8;1-9. doi: 10.1080/09638288.2023.2208377. Online ahead of print.

Purpose: The aim of this study was to explore the acceptability of a 10-week progressive resistance training programme from the perspective of ambulatory adolescents with CP and physiotherapists. Material and methods: Semi-structured interviews were conducted with 32 adolescents with spastic CP, aged 10-19 years in Gross Motor Function Classification System (GMFCS) levels I-III, and 13 physiotherapists. Adolescents had completed a 10-week progressive resistance training programme and physiotherapists had delivered the programme. The Framework Method was used to analyse data. Results: The analysis identified four themes. "It's do-able" described the acceptability of the programme structure, including the frequency of sessions and the duration of the programme. "They were difficult but I did it" described the acceptability of the exercises. "It is completely different," explored the experience of using equipment to progress the programme and "I wish I could do it on a permanent basis" discussed continuing to participate in resistance training. Conclusions: Findings suggest that resistance training is largely acceptable to adolescents and physiotherapists. Acceptability was enhanced by having a weekly supervised session and being able to adapt and progress the exercises to meet the individual's ability. However, there are challenges to implementing progressive resistance training as part of routine practice. Clinical trial registration number: ISRCTN90378161.

PMID: [37154619](#)

#### **16. The contribution of epidemiology to the understanding of neurodevelopmental disabilities**

Nigel Paneth

Review Dev Med Child Neurol. 2023 May 7. doi: 10.1111/dmcn.15633. Online ahead of print.

Epidemiological approaches have played an important role in creating better understanding of developmental disabilities by delineating their frequency in populations and changes in their frequency over time, by identifying etiological factors, and by documenting pathways to prevention. Both cerebral palsy (CP) and mild intellectual disability are declining in frequency in high-income countries. The diagnosis of autism spectrum disorder has increased in recent decades, but much of this increase is a result of changing approaches to ascertainment and recording. Epidemiological studies have found that most CP is not of birth-asphyxial origin, that most febrile seizures do not pose a major risk for epilepsy, and that folic acid deficiency may contribute to developmental disabilities apart from its effect on neural tube defects. Epidemiological research has shown that an important fraction of neural tube defects and virtually all cases of Reye syndrome are preventable, and recent trials have shown ways to prevent CP. Early psychoeducational interventions in children at risk for mild intellectual disability are an effective and valuable societal investment. Very large population-based studies starting in pregnancy have been launched in Norway, Denmark, and Japan in recent years and these and other population studies promise to continue the epidemiological contribution to a better understanding of developmental disabilities.

PMID: [37149891](#)

### 17. Longitudinal Changes in the Parenting Stress of Mothers of Children with Cerebral Palsy and Their Relationship with Children's Gross Motor Function System Levels

Eun-Young Park

Healthcare (Basel). 2023 May 4;11(9):1317. doi: 10.3390/healthcare11091317.

Stress caused by children with disabilities harms the growth and development of children and their families. The present study aimed to investigate whether parenting stress of mothers of children with cerebral palsy changes and the relationship between children's gross motor function level and changes in parenting stress. Data were collected from 162 children with cerebral palsy and their mothers over a 2-year period at three time points. Gross motor function and parenting stress were assessed using the Gross Motor Function Classification System and the Korean version of the Parenting Stress Index-Short Form. Linear latent growth curve models of Wave 2 and Wave 3 variation in parenting stress were constructed. The relationship between Gross Motor Function Classification System level and parenting stress was evaluated via latent growth modeling. The results showed that the linear variation models reflected the time evolution of parenting stress. There were individual differences in parenting stress at the initial level and no individual differences in changes in parenting stress. The relationship between the initial level and the change rate of parenting stress was not significant. Higher initial values of the Gross Motor Function Classification System level were associated with higher initial values of parenting stress, but not related to a change in parenting stress. The results showed that parenting stress of mothers with children with cerebral palsy decreased over time and that Gross Motor Function Classification System level was related to parenting stress level. Based on these findings, directions for further research are put forth.

PMID: [37174859](#)

### 18. Clinical Considerations for Implanted Neurological Devices in Patients Undergoing Hyperbaric Oxygen Therapy: A Case Report and Review of Manufacturer Guidelines

Simone Schiavo, Connor T A Brenna, Anuj Bhatia, William J Middleton, Rita Katznelson

Review Int J Environ Res Public Health. 2023 May 1;20(9):5693. doi: 10.3390/ijerph20095693.

Patients with implanted medical devices are increasingly referred for hyperbaric oxygen therapy (HBOT), and the safety of exposing some of these devices to hyperbaric environments has not previously been explored. There is a paucity of evidence surrounding the management of implanted neurological devices such as neurostimulators and intrathecal drug delivery (IDD) pumps in the context of HBOT. However, these devices can be expected to harbor unique risks; for example, vacant space in the reservoir of an implanted IDD pump may change in pressure and volume during the compression and decompression phases of HBOT, resulting in a damaged or dysfunctional device. We present the case of a 27-year-old woman with cerebral palsy referred for HBOT to manage a necrotizing soft tissue infection cultured from a dehiscence abdominal wound at the previous implantation site of an intrathecal baclofen pump. An HBOT protocol was ultimately chosen in partnership with the patient and her family, but treatment was not performed due to a paucity of evidence that the implanted IDD pump could safely withstand hyperbaric exposure. In this review, we have synthesized manufacturer recommendations regarding the management of implanted neurological devices before, during, and after HBOT to inform future decision-making in this setting. Among these recommendations, we highlight that neurostimulators should be switched off for the duration of HBOT and implanted pumps should be refilled prior to each treatment session to minimize empty reservoir space.

PMID: [37174212](#)

### 19. Hyperbilirubinemia Among Infants Born Preterm: Peak Levels and Association with Neurodevelopmental Outcomes

Gonzalo Solis-Garcia, Kamini Raghuram, Sajit Augustine, M Florencia Ricci, Marie St-Hilaire, Deepak Louis, Hala Makary, Junmin Yang, Prakesh S Shah

J Pediatr. 2023 May 10;113458. doi: 10.1016/j.jpeds.2023.113458. Online ahead of print.

Objective: To describe the distribution of peak bilirubin levels among infants born before 29 weeks' gestation in the first 14 days of life and to study the association between quartiles of peak bilirubin levels at different gestational ages and neurodevelopmental outcomes. Design: Multicenter, retrospective, nationwide cohort study of NICUs in the Canadian Neonatal Network and Canadian Neonatal Follow-Up Network, including preterm neonates of 22 to 286 weeks' gestation born between 2010 and 2018. Peak bilirubin levels were recorded during the first 14 days of age. Main outcome was significant neurodevelopmental impairment (sNDI), defined as cerebral palsy with GMFCS >3, or Bayley III-IV scores of <70 in any domain, or visual impairment, or bilateral hearing loss requiring hearing aids. Results: Among 12,554 included newborns, median gestational age was 26 weeks (IQR 25-28) and birth weight was 920g (IQR 750-1105). The median peak bilirubin values increased as gestational age increased [112 mmol/l (6.5 mg/dL) at 22 weeks and 156 mmol/l (9.1 mg/dL) at 28 weeks]. Significant neurodevelopmental impairment was identified in 1116/6638 (16.8%) of children. Multivariable analyses identified

an association between peak bilirubin in the highest quartile and sNDI (aOR 1.27, 95%CI 1.01-1.60) and receipt of hearing aid/cochlear implant (aOR 3.97, 95%CI: 2.01-7.82) compared with the lowest quartile. Conclusion: In this multicenter cohort study, peak bilirubin levels in neonates of <29 weeks' gestation increased with gestational age. Peak bilirubin values in the highest gestational age-specific quartile were associated with significant neurodevelopmental and hearing impairments.

PMID: [37172811](#)

## 20. [Cerebral palsy: new challenges in the era of rare diseases] [Article in Spanish]

Sergio Aguilera Albesa, Diana Marcela Nova Díaz, Elena Aznal Sáinz

Editorial An Sist Sanit Navar. 2023 Apr 29;46(1):e1038. doi: 10.23938/ASSN.1038.

No abstract available

PMID: [37166237](#)

## 21. Electroencephalographic Interbrain Synchronization in Children with Disabilities, their Parents, and Neurologic Music Therapists

Kyurim Kang, Silvia Orlandi, Jason Leung, Masuma Akter, Nicole Lorenzen, Tom Chau, Michael H Thaut

Eur J Neurosci. 2023 May 10. doi: 10.1111/ejn.16036. Online ahead of print.

As with typically developing children, children with cerebral palsy (CP) and autism spectrum disorder (ASD) develop important socio-emotional rapport with their parents and healthcare providers. However, the neural mechanisms underlying these relationships have less studied. By simultaneously measuring the brain activity of multiple individuals, interbrain synchronization could serve as a neurophysiological marker of social-emotional responses. Music evokes emotional and physiological responses and enhances social cohesion. These characteristics of music have fostered its deployment as a therapeutic medium in clinical settings. Therefore, this study investigated two aspects of interbrain synchronization, namely its phase and directionality, in child-parent (CP) and child-therapist (CT) dyads during music and storytelling session (as a comparison). A total of 17 participants (7 CP or ASD children [aged 12-18 years], their parents, and 3 neurologic music therapists) completed this study, comprising 7 CP and 7 CT dyads. Each music therapist worked with two or three children. We found that session type, dyadic relationship, frequency-band, and brain-region were significantly related to the degree of interbrain synchronization and its directionality. Particularly, music sessions and CP dyads were associated with higher interbrain synchronization and stronger directionality. Delta (0.5-4 Hz) range showed the highest PLV in both CP and CT dyads in frontal brain regions. It appears that synchronization is directed predominantly from parent to child, i.e. parents and music therapists' brain activity tended to influence a child's. Our findings encourage further research into neural synchrony in children with disabilities, especially in musical contexts, and its implications for social and emotional development.

PMID: [37164644](#)

## 22. Umbilical cord pH, blood gases, and lactate at birth: normal values, interpretation, and clinical utility

Per Olofsson

Review Am J Obstet Gynecol. 2023 May;228(5S):S1222-S1240. doi: 10.1016/j.ajog.2022.07.001. Epub 2023 Mar 19.

Normal birth is a eustress reaction, a beneficial hedonic stress with extremely high catecholamines that protects us from intrauterine hypoxia and assists in the rapid shift to extrauterine life. Occasionally the cellular O<sub>2</sub> requirement becomes critical and an O<sub>2</sub> deficit in blood (hypoxemia) may evolve to a tissue deficit (hypoxia) and finally a risk of organ damage (asphyxia). An increase in H<sup>+</sup> concentration is reflected in a decrease in pH, which together with increased base deficit is a proxy for the level of fetal O<sub>2</sub> deficit. Base deficit (or its negative value, base excess) was introduced to reflect the metabolic component of a low pH and to distinguish from the respiratory cause of a low pH, which is a high CO<sub>2</sub> concentration. Base deficit is a theoretical estimate and not a measured parameter, calculated by the blood gas analyzer from values of pH, the partial pressure of CO<sub>2</sub>, and hemoglobin. Different brands of analyzers use different calculation equations, and base deficit values can thus differ by multiples. This could influence the diagnosis of metabolic acidosis, which is commonly defined as a pH <7.00 combined with a base deficit ≥12.0 mmol/L in umbilical cord arterial blood. Base deficit can be calculated as base deficit in blood (or actual base deficit) or base deficit in extracellular fluid (or standard base deficit). The extracellular fluid compartment represents the blood volume diluted with the interstitial fluid. Base deficit in extracellular fluid is advocated for fetal blood because a high partial pressure of CO<sub>2</sub> (hypercapnia) is common in newborns without concomitant hypoxia, and hypercapnia has a strong influence on the pH value, then termed respiratory acidosis. An increase in partial pressure of CO<sub>2</sub> causes less increase in base deficit in extracellular fluid than in base deficit in blood, thus base deficit in extracellular fluid better represents the metabolic component of acidosis. The different types of base deficit for defining metabolic acidosis in cord



blood have unfortunately not been noticed by many obstetrical experts and organizations. In addition to an increase in H<sup>+</sup> concentration, the lactate production is accelerated during hypoxia and anaerobic metabolism. There is no global consensus on definitions of normal cord blood gases and lactate, and different cutoff values for abnormality are used. At a pH <7.20, 7% to 9% of newborns are deemed academic; at <7.10, 1% to 3%; and at <7.00, 0.26% to 1.3%. From numerous studies of different eras and sizes, it can firmly be concluded that in the cord artery, the statistically defined lower pH limit (mean -2 standard deviations) is 7.10. Given that the pH for optimal enzyme activity differs between different cell types and organs, it seems difficult to establish a general biologically critical pH limit. The blood gases and lactate in cord blood change with the progression of pregnancy toward a mixed metabolic and respiratory acidemia because of increased metabolism and CO<sub>2</sub> production in the growing fetus. Gestational age-adjusted normal reference values have accordingly been published for pH and lactate, and they associate with Apgar score slightly better than stationary cutoffs, but they are not widely used in clinical practice. On the basis of good-quality data, it is reasonable to set a cord artery lactate cutoff (mean +2 standard deviations) at 10 mmol/L at 39 to 40 weeks' gestation. For base deficit, it is not possible to establish statistically defined reference values because base deficit is calculated with different equations, and there is no consensus on which to use. Arterial cord blood represents the fetus better than venous blood, and samples from both vessels are needed to validate the arterial origin. A venoarterial pH gradient of <0.02 is commonly used to differentiate arterial from venous samples. Reference values for pH in cord venous blood have been determined, but venous blood comes from the placenta after clearance of a surplus of arterial CO<sub>2</sub>, and base deficit in venous blood then overestimates the metabolic component of fetal acidosis. The ambition to increase neonatal hemoglobin and iron depots by delaying cord clamping after birth results in falsely acidic blood gas and lactate values if the blood sampling is also delayed. Within seconds after birth, sour metabolites accumulated in peripheral tissues and organs will flood into the central circulation and further to the cord arteries when the newborn starts to breathe, move, and cry. This influence of "hidden acidosis" can be avoided by needle puncture of unclamped cord vessels and blood collection immediately after birth. Because of a continuing anaerobic glycolysis in the collected blood, it should be analyzed within 5 minutes to not result in a falsely high lactate value. If the syringe is placed in ice slurry, the time limit is 20 minutes. For pH, it is reasonable to wait no longer than 15 minutes if not in ice. Routine analyses of cord blood gases enable perinatal audits to gain the wisdom of hindsight, to maintain quality assurance at a maternity unit over years by following the rate of neonatal acidosis, to compare results between hospitals on regional or national bases, and to obtain an objective outcome measure in clinical research. Given that the intrapartum cardiotocogram is an uncertain proxy for fetal hypoxia, and there is no strong correlation between pathologic cardiotocograms and fetal acidosis, a cord artery pH may help rather than hurt a staff person subjected to a malpractice suit based on undesirable cardiotocogram patterns. Contrary to common beliefs and assumptions, up to 90% of cases of cerebral palsy do not originate from intrapartum events. Future research will elucidate whether cell injury markers with point-of-care analysis will become valuable in improving the dating of perinatal injuries and differentiating hypoxic from nonhypoxic injuries.

PMID: [37164495](#)

### 23. Improving the interpretation of electronic fetal monitoring: the fetal reserve index

Mark I Evans, David W Britt, Shara M Evans, Lawrence D Devoe

Review Am J Obstet Gynecol. 2023 May;228(5S):S1129-S1143. doi: 10.1016/j.ajog.2022.11.1275. Epub 2023 Mar 17.

Electronic fetal monitoring, particularly in the form of cardiotocography, forms the centerpiece of labor management. Initially successfully designed for stillbirth prevention, there was hope to also include prediction and prevention of fetal acidosis and its sequelae. With the routine use of electronic fetal monitoring, the cesarean delivery rate increased from <5% in the 1970s to >30% at present. Most at-risk cases produced healthy babies, resulting in part from considerable confusion as to the differences between diagnostic and screening tests. Electronic fetal monitoring is clearly a screening test. Multiple attempts have aimed at enhancing its ability to accurately distinguish babies at risk of in utero injury from those who are not and to do this in a timely manner so that appropriate intervention can be performed. Even key electronic fetal monitoring opinion leaders admit that this goal has yet to be achieved. Our group has developed a modified approach called the "Fetal Reserve Index" that contextualizes the findings of electronic fetal monitoring by formally including the presence of maternal, fetal, and obstetrical risk factors and increased uterine contraction frequencies and breaking up the tracing into 4 quantifiable components (heart rate, variability, decelerations, and accelerations). The result is a quantitative 8-point metric, with each variable being weighted equally in version 1.0. In multiple previously published refereed papers, we have shown that in head-to-head studies comparing the fetal reserve index with the American College of Obstetricians and Gynecologists' fetal heart rate categories, the fetal reserve index more accurately identifies babies born with cerebral palsy and could also reduce the rates of emergency cesarean delivery and vaginal operative deliveries. We found that the fetal reserve index scores and fetal pH and base excess actually begin to fall earlier in the first stage of labor than was commonly appreciated, and the fetal reserve index provides a good surrogate for pH and base excess values. Finally, the last fetal reserve index score before delivery combined with early analysis of neonatal heart rate and acid/base balance shows that the period of risk for neonatal neurologic impairment can continue for the first 30 minutes of life and requires much closer neonatal observation than is currently being done.

PMID: [37164491](#)

#### **24. Assessing engagement in rehabilitation: development, validity, reliability, and responsiveness to change of the Rehabilitation Observation Measure of Engagement (ROME)**

Dalina Delfing, Karen Chin, Larissa Hentrich, Jaya Rachwani, Kathleen M Friel, Victor Santamaria, Christine Imms, Andrew M Gordon

Disabil Rehabil. 2023 May 10;1-10. doi: 10.1080/09638288.2023.2208379. Online ahead of print.

**Purpose:** We describe the development of an observational video coding tool, the Rehabilitation Observation Measure of Engagement (ROME), to quantify engagement in rehabilitative settings at the person (internal state of an individual) and between-system (interaction between individuals) level. **Methods:** Forty-nine children with unilateral spastic cerebral palsy (29 males; Age: M = 9.28 yrs, SD = 3.08 yrs) and their interventionists were videotaped during different activities. Construct validity was examined by correlating the ROME with the Engagement vs. Disaffection with Learning Survey and the Pediatric Rehabilitation Intervention Measure of Engagement - Observation questionnaire. Inter- and intra-rater reliability were examined using two independent raters. The ROME's responsiveness to change was examined by comparing scores across activities. **Results:** For construct validity, results showed a positive correlation for person-level engagement ( $r = 0.444$ ,  $p = 0.003$ ). No relationship was found between-system-level engagement. High intrarater (91.8%) and interrater (96.1%) reliability was found. The ROME's responsiveness to change was supported by children exhibiting lower engagement scores during repetitive shaping activities. **Conclusion:** These findings provide evidence that the ROME is a reliable tool to objectively examine the construct of engagement within rehabilitation and is valid for quantifying person-level engagement. It provides information that cannot be extracted from questionnaires and can help guide intervention decisions.

PMID: [37161867](#)

#### **25. Fatigue experienced by people with cerebral palsy: a systematic review of assessment tools and decision tree**

Iain Dutia, Robert Eres, Susan M Sawyer, Jacinta Pennacchia, Leanne M Johnston, Stacey Cleary, Dinah Reddihough, David Coghill

Disabil Rehabil. 2023 May 9;1-9. doi: 10.1080/09638288.2023.2205175. Online ahead of print.

**Purpose:** To conduct a systematic review of self- and proxy-report fatigue assessment tools used in studies of people with cerebral palsy (CP) of all ages, and to develop a fatigue assessment tool decision tree for clinicians and researchers. **Materials and methods:** Five electronic databases (MEDLINE, PsycInfo, CINAHL, Web of Science and Cochrane) were searched to September 2021 to identify studies assessing self-reported fatigue in people with CP of any age. The assessment tools utilised were extracted and two reviewers appraised the tool characteristics, clinical utility and psychometric properties. A decision tree for selecting fatigue assessment tools was constructed. **Results:** Ten assessment tools were identified across thirty-nine studies, three of which are valid and reliable for assessing fatigue severity and impact in people with CP. A four-level fatigue assessment tool decision tree was constructed. No valid and reliable tool for assessing cognitive fatigue was identified; responsiveness has not been evaluated in any tool for people with CP. **Conclusions:** Physical fatigue screening and assessment tools for people with CP are available and are presented in our decision tree, however their utility as outcome measures remains unclear. Cognitive fatigue is understudied and poorly understood, further work is required in this area. **IMPLICATIONS FOR REHABILITATION** Current measurement tools to screen and assess physical fatigue in people with cerebral palsy (CP) are valid and reliable and are presented in our 4-level decision tree to guide assessment tool selection. The responsiveness of these measurement tools to screen and assess physical fatigue has not been evaluated, therefore their utility as outcome measures in people with CP is unclear. Cognitive fatigue is understudied and poorly understood in people with CP. Valid and reliable tools to assess cognitive fatigue in people with CP are not available.

PMID: [37158234](#)

#### **26. Assessment of Corticosteroid Therapy and Death or Disability According to Pretreatment Risk of Death or Bronchopulmonary Dysplasia in Extremely Preterm Infants**

Erik A Jensen, Laura Elizabeth Wiener, Matthew A Rysav, Kevin C Dysart, Marie G Gantz, Eric C Eichenwald, Rachel G Greenberg, Heidi M Harmon, Matthew M Laughon, Kristi L Watterberg, Michele C Walsh, Bradley A Yoder, Scott A Lorch, Sara B DeMauro; Eunice Kennedy Shriver National Institute of Child Health and Human Development Neonatal Research Network

JAMA Netw Open. 2023 May 1;6(5):e2312277. doi: 10.1001/jamanetworkopen.2023.12277.

**Importance:** Meta-analyses suggest that corticosteroids may be associated with increased survival without cerebral palsy in infants at high risk of bronchopulmonary dysplasia (BPD) but are associated with adverse neurologic outcomes in low-risk infants. Whether this association exists in contemporary practice is uncertain because most randomized clinical trials administered corticosteroids earlier and at higher doses than currently recommended. **Objective:** To evaluate whether the pretreatment risk of death or grade 2 or 3 BPD at 36 weeks' postmenstrual age modified the association between postnatal

corticosteroid therapy and death or disability at 2 years' corrected age in extremely preterm infants. Design, setting, and participants: This cohort study analyzed data on 482 matched pairs of infants from 45 participating US hospitals in the National Institute of Child Health and Human Development Neonatal Research Network Generic Database (GDB). Infants were included in the cohort if they were born at less than 27 weeks' gestation between April 1, 2011, and March 31, 2017; survived the first 7 postnatal days; and had 2-year death or developmental follow-up data collected between January 2013 and December 2019. Corticosteroid-treated infants were propensity score matched with untreated controls. Data were analyzed from September 1, 2019, to November 30, 2022. Exposure: Systemic corticosteroid therapy to prevent BPD that was initiated between day 8 and day 42 after birth. Main outcomes and measures: The primary outcome was death or moderate to severe neurodevelopmental impairment at 2 years' corrected age. The secondary outcome was death or moderate to severe cerebral palsy at 2 years' corrected age. Results: A total of 482 matched pairs of infants (mean [SD] gestational age, 24.1 [1.1] weeks); 270 males [56.0%]) were included from 656 corticosteroid-treated infants and 2796 potential controls. Most treated infants (363 [75.3%]) received dexamethasone. The risk of death or disability associated with corticosteroid therapy was inversely associated with the estimated pretreatment probability of death or grade 2 or 3 BPD. The risk difference for death or neurodevelopmental impairment associated with corticosteroids decreased by 2.7% (95% CI, 1.9%-3.5%) for each 10% increase in the pretreatment risk of death or grade 2 or 3 BPD. This risk transitioned from estimated net harm to benefit when the pretreatment risk of death or grade 2 or 3 BPD exceeded 53% (95% CI, 44%-61%). For death or cerebral palsy, the risk difference decreased by 3.6% (95% CI, 2.9%-4.4%) for each 10% increase in the risk of death or grade 2 or 3 BPD and transitioned from estimated net harm to benefit at a pretreatment risk of 40% (95% CI, 33%-46%). Conclusions and relevance: Results of this study suggested that corticosteroids were associated with a reduced risk of death or disability in infants at moderate to high pretreatment risk of death or grade 2 or 3 BPD but with possible harm in infants at lower risk.

PMID: [37155165](#)

## 27. PredictMed-epilepsy: A multi-agent based system for epilepsy detection and prediction in neuropediatrics

Carlo M Bertoncelli, Stefania Costantini, Fabio Persia, Domenico Bertoncelli, Daniela D'Auria

Comput Methods Programs Biomed. 2023 Apr 21;236:107548. doi: 10.1016/j.cmpb.2023.107548. Online ahead of print.

Epileptic seizures are associated with a higher incidence of Developmental Disabilities and Cerebral Palsy. Early evaluation and management of epilepsy is strongly recommended. We propose and discuss an application to predict epilepsy (PredictMed-Epilepsy) and seizures via a deep-learning module (PredictMed-Seizures) encompassed within a multi-agent based healthcare system (PredictMed-MHS); this system is meant, in perspective, to be integrated into a clinical decision support system (PredictMed-CDSS). PredictMed-Epilepsy, in particular, aims to identify factors associated with epilepsy in children with Developmental Disabilities and Cerebral Palsy by using a prediction-learning model named PredictMed. PredictMed-epilepsy methods: We performed a longitudinal, multicenter, double-blinded, descriptive study of one hundred and two children with Developmental Disabilities and Cerebral Palsy (58 males, 44 females; 65 inpatients, 37 outpatients; 72 had epilepsy - 22 of intractable epilepsy, age: 16.6±1.2y, range: 12-18y). Data from 2005 to 2021 on Cerebral Palsy etiology, diagnosis, type of epilepsy and spasticity, clinical history, communication abilities, behaviors, intellectual disability, motor skills, and eating and drinking abilities were collected. The machine-learning model PredictMed was exploited to identify factors associated with epilepsy. The guidelines of the "Transparent Reporting of a multivariable prediction model for Individual Prognosis or Diagnosis" Statement (TRIPOD) were followed. PredictMed-epilepsy results: Cerebral Palsy etiology [(prenatal > perinatal > postnatal causes) p=0.036], scoliosis (p=0.048), communication (p=0.018) and feeding disorders (p=0.002), poor motor function (p<0.001), intellectual disabilities (p=0.007), and type of spasticity [(quadriplegia/tripleplegia > diplegia > hemiplegia), p=0.002] were associated with having epilepsy. The prediction model scored an average of 82% of accuracy, sensitivity, and specificity. Thus, PredictMed defined the computational phenotype of children with Developmental Disabilities/Cerebral Palsy at risk of epilepsy. Novel contribution of the work: We have been developing and we have prototypically implemented a Multi-Agent Systems (MAS) that encapsulates the PredictMed-Epilepsy module. More specifically, we have implemented the Patient Observing MAS (PoMAS), which, as a novelty w.r.t. the existing literature, includes a complex event processing module that provides real-time detection of short- and long-term events related to the patient's condition.

PMID: [37149974](#)

## 28. Sex differences in change of direction deficit and asymmetries in footballers with cerebral palsy

Matías Henríquez, Iván Peña-González, Carlos Albaladejo-García, Kabir P Sadarangani, Raul Reina

Scand J Med Sci Sports. 2023 May 6. doi: 10.1111/sms.14383. Online ahead of print.

The aims of this study were (1) to describe and examine differences in change of direction (COD) performance and the magnitude of asymmetries in para-footballers with cerebral palsy (CP) and controls and (2) to evaluate the association between COD outcomes and linear sprint performance. Twenty-eight international para-footballers with CP and thirty-nine non-impaired football players (control group) participated in this study. All participants completed a 10-m sprint and two attempts of the 505 COD test with the dominant and non-dominant leg. The COD deficit was calculated using the difference between the 505 test and the 10-m sprint time, while the asymmetry index was determined by comparing each leg's completion time and

COD deficit. Players across groups showed interlimb asymmetries between the dominant and non-dominant legs in COD outcomes and deficit ( $p < 0.05$ ,  $dg = -0.40$  to  $-1.46$ ), although these asymmetries imbalance were not significantly different between the sexes with and without impairment. Males with CP exhibited a faster directional COD speed and a shorter COD deficit than their female counterparts ( $p < 0.01$ ,  $dg = -1.68$  to  $-2.53$ ). Similarly, the control group had faster scores than the CP groups of the same sex ( $p < 0.05$ ,  $dg = 0.53$  to  $3.78$ ). Lastly, the female CP group and male control groups showed a significant association between sprint and the COD deficit in the dominant leg ( $p < 0.05$ ,  $r = -0.58$  to  $0.65$ ). Therefore, the use of directional dominance, the COD deficit, and asymmetry outcomes could be helpful for classification purposes to assess the impact of the impairment on sport-specific activity testing according to sex.

PMID: [37149724](#)

### 29. Is cerebral palsy associated with successful ureteral access during the initial attempt at ureteroscopy for urolithiasis in children and young adults?

Eric Bortnick, Michael P Kurtz, Bartley G Cilento Jr, Caleb P Nelson

J Pediatr Urol. 2023 Apr 19;S1477-5131(23)00143-2. doi: 10.1016/j.jpuro.2023.04.014. Online ahead of print.

Background: Ureteroscopy is a common treatment for urolithiasis, but initial ureteral access is not always possible, particularly in pediatrics. Clinical experience suggests that neuromuscular conditions such as cerebral palsy (CP) may facilitate access, thus avoiding the need for pre-stenting and staged procedures. Objective: We sought to determine if probability of successful ureteral access (SUA) during initial attempted ureteroscopy (IAU) is higher in pediatric patients with CP vs. without CP. Study design: We reviewed IAU cases for urolithiasis (2010-2021) at our center. Patients with pre-stenting, prior ureteroscopy, or urologic surgical history were excluded. CP was defined using ICD-10 codes. SUA was defined as scope access to urinary tract level sufficient to reach stone. Association of CP and other factors with SUA were evaluated. Results: 230 patients (45.7% male, median age: 16 years [IQR: 12-18 y], 8.7% had CP) underwent IAU, with SUA in 183 (79.6%). SUA occurred in 90.0% of patients with CP vs. 78.6% of those without CP ( $p = 0.38$ ). SUA was 81.7% in patients  $>12$  years (vs. 73.8% in those  $<12$ ), and the highest SUA was in those  $>12$  years with CP (93.3%), but these differences were not statistically significant. Renal stone location was significantly associated with lower SUA ( $p = 0.007$ ). Among patients with renal stone only, SUA in those with CP was 85.7% vs. 68.9% in those without CP ( $p = 0.33$ ). SUA did not differ significantly by gender or BMI. Conclusions: CP may facilitate ureteral access during IAU in pediatric patients, but we were unable to show a statistically significant difference. Further study of larger cohorts may demonstrate whether CP or other patient factors are associated with successful initial access. Improved understanding of such factors would help preoperative counseling and surgical planning for children with urolithiasis.

PMID: [37149475](#)

## Prevention and Cure

### 30. White matter injury detection based on preterm infant cranial ultrasound images

Juncheng Zhu, Shifa Yao, Zhao Yao, Jinhua Yu, Zhaoxia Qian, Ping Chen

Front Pediatr. 2023 Apr 20;11:1144952. doi: 10.3389/fped.2023.1144952. eCollection 2023.

Introduction: White matter injury (WMI) is now the major disease that seriously affects the quality of life of preterm infants and causes cerebral palsy of children, which also causes periventricular leuko-malacia (PVL) in severe cases. The study aimed to develop a method based on cranial ultrasound images to evaluate the risk of WMI. Methods: This study proposed an ultrasound radiomics diagnostic system to predict the WMI risk. A multi-task deep learning model was used to segment white matter and predict the WMI risk simultaneously. In total, 158 preterm infants with 807 cranial ultrasound images were enrolled. WMI occurred in 32 preterm infants (20.3%, 32/158). Results: Ultrasound radiomics diagnostic system implemented a great result with AUC of 0.845 in the testing set. Meanwhile, multi-task deep learning model preformed a promising result both in segmentation of white matter with a Dice coefficient of 0.78 and prediction of WMI risk with AUC of 0.863 in the testing cohort. Discussion: In this study, we presented a data-driven diagnostic system for white matter injury in preterm infants. The system combined multi-task deep learning and traditional radiomics features to achieve automatic detection of white matter regions on the one hand, and design a fusion strategy of deep learning features and manual radiomics features on the other hand to obtain stable and efficient diagnostic performance.

PMID: [37152321](#)

### **31. Does Antenatal MgSO<sub>4</sub> Administration to the Mother in the Event of Imminent Premature Birth Reduce the Occurrence of Infantile Cerebral Palsy in the Child? - An Umbrella Review**

Charlotte Binder, Pauline Schmid, Harald Abele, Joachim Graf

Geburtshilfe Frauenheilkd. 2023 May 4;83(5):602-611. doi: 10.1055/a-2049-2976. eCollection 2023 May.

**Introduction.** Premature births have a significantly increased risk of developing cerebral palsy. This clinical picture involves great restrictions and impairments in the lives of the children and their families. Its prevention is therefore of great importance. One method of neuroprotection to reduce the rate of infantile cerebral palsy is the antenatal administration of magnesium sulfate to the mother. The aim of this paper is to present the current state of research of existing reviews and meta-analyses on the topic and to review the evidence for this intervention. **Material and Methods** A literature search was conducted within the framework of an umbrella review in the electronic database PubMed in February 2022 to identify all relevant publications on the topic. The search was structured using the PRISMA statement. The important methodological characteristics and the results of the studies were then extracted. In addition, a quality assessment of the studies was performed using the AMSTAR score. **Results** Two systematic reviews with meta-analysis, one systematic review, and one individual participant data meta-analysis were included in this study. The total number of subjects was n = 6178. The publications conclude that the antenatal administration of magnesium sulfate to the mother significantly reduces the risk of cerebral palsy in preterm infants. Due to the high quality of 3 of the 4 studies, a high level of evidence can be assumed. **Conclusion** The evidence for antenatal magnesium sulfate administration for the prophylaxis of cerebral palsy in preterm infants is high. However, further research is needed to determine which doses of magnesium and up to which gestational age the administration is useful.

PMID: [37169015](#)

### **32. Therapeutic hypothermia as a neuroprotective strategy in newborns with perinatal asphyxia-case report**

Nayara Rodrigues Gomes de Oliveira, Gustavo Gonçalves Teixeira, Kathlen Terezinha Montes Soares Fernandes, Marla Moreira Avelar, Maja Medeiros, Cibelle Kayenne Martins Roberto Formiga

Case Reports Front Rehabil Sci. 2023 Apr 19;4:1132779. doi: 10.3389/fresc.2023.1132779. eCollection 2023.

**Background:** Perinatal asphyxia is a public health problem and the third major cause of death among children under 5 years. **Objective:** Two clinical cases of newborns with perinatal asphyxia submitted to therapeutic hypothermia and the follow-up of their motor development after hospital discharge have been reported. **Methods:** This retrospective case report study included two newborns with hypoxic-ischemic encephalopathy due to perinatal asphyxia who received a hypothermia protocol at the neonatal intensive care unit (NICU). The two newborns and their families were followed up at the outpatient clinic and assessed using the Hammersmith Child Neurological Examination, Alberta Child Motor Scale, and Denver Developmental Screening Test-II. **Results:** The newborns were submitted to a 72-hour hypothermia protocol. One newborn remained for 13 days in the NICU, while the other remained for 22 days. According to the multidisciplinary team, both cases presented with typical motor development with no cerebral palsy during the follow-up. **Conclusion:** Both cases showed positive results and a good prognostic for motor development. Therapeutic hypothermia may be a strategy to prevent neurologic sequelae in newborns with perinatal asphyxia, including cerebral palsy.

PMID: [37152243](#)