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## Interventions and Management

### **1. Hyperselective neurectomy in the treatment of elbow and wrist spasticity: an anatomical study and incision design** Aiping Yu, Yundong Shen, Yanqun Qiu, Su Jiang, Yongchun Yu, Huawei Yin, Wendong Xu

Br J Neurosurg. 2020 Sep 21;1-6. doi: 10.1080/02688697.2020.1823939. Online ahead of print.

**Objective:** Hyperselective neurectomy is used to treat spastic arm paralysis. The aim of the study was to analyze the nerve branching patterns of elbow and wrist flexors/pronator to inform hyperselective neurectomy approached. **Methods:** Eighteen upper extremities of fresh cadaver specimen were dissected. The number of motor branches from the musculocutaneous nerve to biceps brachii and brachialis, median nerve to pronator teres, flexor carpi radialis and ulnar nerve to flexor carpi ulnaris were counted. The origin site of each primary motor branch was documented. **Results:** Either biceps or brachialis was innervated by one or two primary motor branches. Pronator teres was innervated by one to three motor trunks and the pattern for flexor carpi radialis was a common trunk with other branches. The origin of the biceps and brachialis nerve trunk was located approximately 30% to 60% of the length of the arm. The median nerve branched to pronator teres and flexor carpi radialis at the region about 34mm (SD 18.8mm) above and 50mm (SD 14.9mm) below the medial epicondyle. Flexor carpi ulnaris was innervated by one to three motor trunks and the mean distance from the medial epicondyle to the origin of flexor carpi ulnaris nerve on ulnar nerve was 18.7 mm (SD 6.5mm). **Conclusion:** Primary motor branches to elbow flexors, wrist flexors and pronators were various, while the regions of their origins were relatively settled. It was recommended the incisions be designed according to the location of the primary motor trunks.

PMID: [32955377](https://pubmed.ncbi.nlm.nih.gov/32955377/)

### **2. The Influence of Hippotherapy on the Body Posture in a Sitting Position among Children with Cerebral Palsy** Ewelina Matusiak-Wieczorek, Elzbieta Dzikowska-Zaborszczyk, Marek Synder, Andrzej Borowski

Int J Environ Res Public Health. 2020 Sep 19;17(18):E6846. doi: 10.3390/ijerph17186846.

The purpose of this study was to assess the influence of hippotherapy (therapy with horses) on posture and body function among children with cerebral palsy. A case-control study included forty-five children aged 6-12 years, classified as Gross Motor Function Classification System (GMFCS) level I or II, with spastic diplegia or hemiplegia. The participants were randomly divided into three groups: study I (n = 15), study II (n = 15) and control (n = 15). The children from the study groups attended 30min hippotherapy sessions for 12 consecutive weeks, twice (study group I) or once (study group II) a week. The Sitting Assessment Scale (SAS) was used. A comparison of SAS showed an improvement in almost all the assessed categories among the children who participated in hippotherapy. In study group I, statistically significant differences were noted in the assessment of head position control, arm function (in both cases, p = 0.012) and trunk control (p = 0.005) and in study group II in the assessment of trunk control (p = 0.028). Hippotherapy has a positive influence on the body posture and function of individual body parts in a sitting position among children with cerebral palsy.

PMID: [32961681](#)

### 3. Spinal Deformity Surgery in Pediatric Patients With Cerebral Palsy: A National-Level Analysis of Inpatient and Postdischarge Outcomes

Nathan J Lee, Michael Fields, Venkat Boddapati, Justin Mathew, Daniel Hong, Zeeshan M Sardar, Paulo R Selber, Benjamin Roye, Michael G Vitale, Lawrence G Lenke

Global Spine J. 2020 Sep 23;2192568220960075. doi: 10.1177/2192568220960075. Online ahead of print.

Study design: Retrospective cohort. Objective: To provide a national-level assessment of the short-term outcomes after spinal deformity surgery in pediatric patients with cerebral palsy. Methods: A national, prospectively collected database was queried to identify pediatric ( $\leq 18$  years) patients with cerebral palsy, who underwent spinal fusion surgery from 2012 to 2017. Separate multivariate analyses were performed for the primary outcomes of interest including extended length of stay ( $>75$ th percentile,  $>8$  days), and readmissions within 90 days after the index admission. Results: A total of 2856 patients were reviewed. The mean age  $\pm$  standard deviation was  $12.8 \pm 2.9$  years, and 49.4% of patients were female. The majority of patients underwent a posterior spinal fusion (97.0%) involving  $\geq 8$  levels (79.9%) at a teaching hospital (96.6%). Top medical complications (24.5%) included acute respiratory failure requiring mechanical ventilation (11.4%), paralytic ileus (8.2%), and urinary tract infections (4.6%). Top surgical complications (40.7%) included blood transfusion (35.6%), wound complication (4.9%), and mechanical complication (2.7%). The hospital cost for patients with a length of hospital stay  $>8$  days (\$113 669) was nearly double than that of those with a shorter length of stay (\$68 411). The 90-day readmission rate was 17.6% (mean days to readmission: 30.2). The most common reason for readmission included wound dehiscence (21.1%), surgical site infection (19.1%), other infection (18.9%), dehydration (16.9%), feeding issues (14.5%), and acute respiratory failure (13.1%). Notable independent predictors for 90-day readmissions included preexisting pulmonary disease (odds ratio [OR] 1.5), obesity (OR 3.4), cachexia (OR 27), nonteaching hospital (OR 3.5), inpatient return to operating room (OR 1.9), and length of stay  $>8$  days (OR 1.5). Conclusions: Efforts focused on optimizing the perioperative pulmonary, hematological, and nutritional status as well as reducing wound complications appear to be the most important for improving clinical outcomes.

PMID: [32964747](#)

### 4. Investigating Passive Muscle Mechanics With Biaxial Stretch

Benjamin B Wheatley

Front Physiol. 2020 Aug 20;11:1021. doi: 10.3389/fphys.2020.01021. eCollection 2020.

Introduction: The passive stiffness of skeletal muscle can drastically affect muscle function in vivo, such as the case for fibrotic tissue or patients with cerebral palsy. The two constituents of skeletal muscle that dominate passive stiffness are the intracellular protein titin and the collagenous extracellular matrix (ECM). However, efforts to correlate stiffness and measurements of specific muscle constituents have been mixed, and thus the complete mechanisms for changes to muscle stiffness remain unknown. We hypothesize that biaxial stretch can provide an improved approach to evaluating passive muscle stiffness. Methods: We performed planar biaxial materials testing of passively stretched skeletal muscle and identified three previously published datasets of uniaxial materials testing. We developed and employed a constitutive model of passive skeletal muscle that includes aligned muscle fibers and dispersed ECM collagen fibers with a bimodal von Mises distribution. Parametric modeling studies and fits to experimental data (both biaxial and previously published) were completed. Results: Biaxial data exhibited differences in time dependent behavior based on orientation ( $p < 0.0001$ ), suggesting different mechanisms supporting load in the direction of muscle fibers (longitudinal) and in the perpendicular (transverse) directions. Model parametric studies and fits to experimental data exhibited the robustness of the model ( $<20\%$  error) and how differences in tissue stiffness may not be observed in uniaxial longitudinal stretch, but are apparent in biaxial stretch. Conclusion: This work presents novel materials testing data of passively stretched skeletal muscle and use of constitutive modeling and finite element analysis to explore the interaction between stiffness, constituent variability, and applied deformation in passive skeletal muscle. The results highlight the importance of biaxial stretch in evaluating muscle stiffness and in further considering the role of ECM collagen in modulating passive muscle stiffness.

PMID: [32973555](#)

### 5. Maturation of the Locomotor Circuitry in Children With Cerebral Palsy

Germana Cappellini, Francesca Sylos-Labini, Arthur H Dewolf, Irina A Solopova, Daniela Morelli, Francesco Lacquaniti, Yury Ivanenko

Review Front Bioeng Biotechnol. 2020 Aug 18;8:998. doi: 10.3389/fbioe.2020.00998. eCollection 2020.

The first years of life represent an important phase of maturation of the central nervous system, processing of sensory information, posture control and acquisition of the locomotor function. Cerebral palsy (CP) is the most common group of motor disorders in childhood attributed to disturbances in the fetal or infant brain, frequently resulting in impaired gait. Here we will consider various findings about functional maturation of the locomotor output in early infancy, and how much the dysfunction of gait in children with CP can be related to spinal neuronal networks vs. supraspinal dysfunction. A better knowledge about pattern generation circuitries in infancy may improve our understanding of developmental motor disorders, highlighting the necessity for regulating the functional properties of abnormally developed neuronal locomotor networks as a target for early sensorimotor rehabilitation. Various clinical approaches and advances in biotechnology are also considered that might promote acquisition of the locomotor function in infants at risk for locomotor delays.

PMID: [32974319](#)

### 6. [Evaluation of function and limiting factors of gait disorder treatment in cerebral palsy: development of the Walking Abilities Levels Classification System][Article in Spanish]

I Martínez-Caballero, G Chorbajian-Alonso, R M Egea-Gámez, A Pérez-Somarrriba Moreno, C H Prato de Lima, C Martín-Gómez, A Ramírez-Barragán, I Monzón-Tobalina

Rev Neurol. 2020 Oct 1;71(7):246-252. doi: 10.33588/rn.7107.2020216.

Introduction: The Gross Motor Function Classification System has allowed us to stratificate cerebral palsy patients, according to their walking abilities. The lack of sensitivity about detecting changes and the absence of a global patient evaluation, justify the search of new pre-operative evaluation tools. Aims: To present the Walking Abilities Levels Classification System (WALCS) and to show the first inter-observer agreement study that has been carried out. This system uses first a different pattern for ordering gait functional skills, and after that, evaluates the reversibility of the contextual factors that may limit the result of a gait disorder treatment. Subjects and methods: A new evaluation frame was built by an interdisciplinary team with an average professional experience of more than 15 years, initially focused as part of the pre-surgical patient evaluation. An inter-observer agreement study was held to gain the first insight of it. 14 participants studied the medical reports and gait lab video images of 10 cases. Results: The kappa index was 0.76 for the walking ability level, 0.79 for the biological type, 0.69 psychological type and 0.64 social type of limiting factors. Conclusions: The WALCS offers a new evaluation frame gathering patient walking skills and limiting factors treatment. The initial inter-observer agreement rate endorsed more intra- and inter-studies in order to achieve a more robust validation.

PMID: [32959356](#)

### 7. Familiarity with Hereditary Spastic Paraplegia (HSP) and Differentiation of Upper Body Gait Characteristics between Children with HSP and Spastic Diplegic Cerebral Palsy

Christina Bickley, Katy Mitchell, Allison Scott, Meredith Bury, Mayowa Oyelami

Phys Occup Ther Pediatr. 2020 Sep 17;1-15. doi: 10.1080/01942638.2020.1819934. Online ahead of print.

Aims: The aim of this two-part, prospective study was to determine therapist familiarity with HSP and examine diagnostic accuracy between individuals with HSP and those with Spastic Diplegic Cerebral Palsy (SD-CP). Methods: Part-one surveyed physical therapists (PT) and physical therapist assistants (PTA) throughout Texas to determine familiarity with HSP and its gait deviations. Part-two examined accuracy in differential diagnosis of HSP versus SD-CP using gait analysis and the effects of an educational module on upper body gait deviations observed in individuals with HSP. Results: Both PTs and PTAs indicated a high degree ( $\geq 73.2\%$ ) of unfamiliarity with HSP. While a majority of respondents ( $\geq 88.7\%$ ) indicated use of observational gait analysis in clinical practice,  $\geq 92.5\%$  indicated never receiving instruction on HSP or its associated gait deviations. Whole group analysis revealed diagnostic accuracy increased 21.7% post educational module. In addition, individual case diagnostic

accuracy yielded significant improvement in 14 out of 20 cases. Conclusions: Physical and occupational therapists are in a unique position to assist with the identification and distinction of HSP from CP. This study demonstrated that brief instruction on common upper body gait deviations seen in individuals with HSP may improve a clinician's ability to distinguish SD-CP from HSP via gait analysis.

PMID: [32942942](#)

### **8. Dissecting Brainstem Locomotor Circuits: Converging Evidence for Cuneiform Nucleus Stimulation**

Stephano J Chang, Iahn Cajigas, Ioan Opris, James D Guest, Brian R Noga

Front Syst Neurosci. 2020 Aug 21;14:64. doi: 10.3389/fnsys.2020.00064. eCollection 2020.

There are a pressing and unmet need for effective therapies for freezing of gait (FOG) and other neurological gait disorders. Deep brain stimulation (DBS) of a midbrain target known as the pedunculopontine nucleus (PPN) was proposed as a potential treatment based on its postulated involvement in locomotor control as part of the mesencephalic locomotor region (MLR). However, DBS trials fell short of expectations, leading many clinicians to abandon this strategy. Here, we discuss the potential reasons for this failure and review recent clinical data along with preclinical optogenetics evidence to argue that another nearby nucleus, the cuneiform nucleus (CnF), may be a superior target.

PMID: [32973468](#)

### **9. Editorial comment to accompany 'Role of Rush rods in proximal femoral osteotomies for cerebral palsy'**

Hans Robert Tuten, Stephanie Washburn

J Pediatr Orthop B. 2020 Sep 15. doi: 10.1097/BPB.0000000000000803. Online ahead of print.

PMID: [32947355](#)

### **10. Changes in Ankle Range of Motion, Gait Function and Standing Balance in Children with Bilateral Spastic Cerebral Palsy after Ankle Mobilization by Manual Therapy**

Pong Sub Youn, Kyun Hee Cho, Shin Jun Park

Children (Basel). 2020 Sep 18;7(9):E142. doi: 10.3390/children7090142.

The aim of this study was to investigate the effect of ankle joint mobilization in children with cerebral palsy (CP) to ankle range of motion (ROM), gait, and standing balance. We recruited 32 children (spastic diplegia) diagnosed with CP and categorized them in two groups: the ankle joint mobilization (n = 16) group and sham joint mobilization (n = 16) group. Thus, following a six-week ankle joint mobilization, we examined measures such as passive ROM in ankle dorsiflexion in the sitting and supine position, center of pressure (COP) displacements (sway length, area) with eyes open (EO) and closed (EC), and a gait function test (timed up and go test (TUG) and 10-m walk test). The dorsiflexion ROM, TUG, and 10-m walk test significantly increased in the mobilization group compared to the control group. Ankle joint mobilization can be regarded as a promising method to increase dorsiflexion and improve gait in CP-suffering children.

PMID: [32961844](#)

### **11. Comprehensive care of the ambulatory child with cerebral palsy (GMFCS I and II): A Canadian perspective [Article in En, En]**

Anne Kawamura, Amber Makino, Scott McLeod

Paediatr Child Health. 2020 Sep 16;25(6):397-398. doi: 10.1093/pch/pxaa100. eCollection 2020 Oct.

In Canada, cerebral palsy (CP) is the most common physical disability, affecting approximately 2 to 3 per 1,000 individuals. Paediatricians are sure to encounter and care for children with CP and their families. The role of the general paediatrician in caring for a child with CP is crucial, from diagnosis to providing a 'medical home', and from ensuring care coordination to delivering anticipatory guidance and preventive health and wellness care. The CP Health and Wellness Record that accompanies this practice point can assist both practitioners and children's families by exploring key areas of health, function, participation, and wellness. This record may be used alongside other evidence-based health promotion guides, such as the Rourke Baby Record and the Greig Health Record, to prompt clinicians caring for ambulatory children with CP (Gross Motor Function Classification System [GMFCS] levels I and II) on specific health issues and domains.

PMID: [32968470](#)

## 12. Dysarthria syndromes in children with cerebral palsy

Theresa Schölderle, Elisabet Haas, Wolfram Ziegler

Dev Med Child Neurol. 2020 Sep 24. doi: 10.1111/dmcn.14679. Online ahead of print.

**Aim:** To investigate whether dysarthria syndromes acquired in adulthood can also be observed in children with cerebral palsy (CP) and, if so, whether they align with children's CP subtypes. **Method:** Twenty-six children with CP participated (mean age 7y 8mo [SD 1y 2mo], 5y 1mo-9y 10mo; 16 males and 10 females). Speech samples were elicited in a computer-based game and were analysed using the auditory perceptual criteria of the Bogenhausen Dysarthria Scales (BoDyS). For statistical classification, three comparison groups of adults with standard dysarthria syndromes (i.e. spastic, hyperkinetic, and ataxic) were used. Their BoDyS data were entered into a mixture discriminant analysis, with data from the comparison groups as the training sample and those from the children with CP as the test sample. Results were related to findings in a group of adults with CP. **Results:** Among the children with CP, most had spastic (n=14), while fewer had ataxic (n=9) or hyperkinetic (n=3), dysarthria. However, syndrome allocations were significantly more ambiguous than in adults with CP. For 11 children, their dysarthria syndromes did not align with their CP subtype. **Interpretation:** Dysarthria syndromes are less clear cut in children than in adults with CP because of a number of developmental factors.

PMID: [32970343](#)

## 13. Efficacy of scopolamine transdermal patch in children with sialorrhea in a pediatric tertiary care hospital

Majed Al Jeraisy, Maissa AlFuraih, Raghad AlSaif, Bushra AlKhalifah, Hazza AlOtaibi, Mostafa A Abolfotouh

BMC Pediatr. 2020 Sep 17;20(1):437. doi: 10.1186/s12887-020-02336-x.

**Background:** Drooling is common in children with neurological disorders, but its management is very challenging. Scopolamine transdermal patch (STP) appears to be useful in controlling drooling, although it is not approved for this indication and there are limited clinical studies about its effectiveness. This study aimed (1) to assess the impact of STP use on the severity of drooling and on the frequency of emergency department (ED) and hospital readmission (RA) visits related to drooling, and (2) to determine the level of family satisfaction with STP when used in children with neurological disorders. **Methods:** This is a retrospective cohort study of all pediatric patients aged 3-14 years, with non-progressive neurodevelopmental disability, who used STP for more than one year during the period between April 2015 and July 2018 (n = 44). Data on demographics, clinical status, comorbidities, STP dose and duration, other medications, ED and RA visits were collected. Follow-up phone-call interviews with parents/caregivers were performed using a parent-reported frequency and severity rating scale of sialorrhea. Absolute and relative risk reductions were calculated to assess the impact of STP on ED and RA visits. Significance was considered at p-value of  $\leq 0.05$ . **Results:** STP use showed significant reduction in severity of drooling (p < 0.001), wiping of the child's mouth (p < 0.001), bibs or clothing changes (p < 0.001), choking and aspiration of saliva (p = 0.001). The Relative Risk Reduction of the drooling-related ED and RA visits were 86% and 67% respectively. Nearly two-thirds (60%) of caregivers were satisfied with using STP. **Conclusions:** This is the first study of its kind done in Saudi Arabia demonstrating favorable impact of STP use by children on the consequences associated with drooling and with the frequency of ER and RA visits due to drooling. Development of a medication use protocol is recommended to standardize STP treatment in order to optimize its effectiveness. This study serves as baseline information for future prospective interventional studies.

PMID: [32943036](#)

#### **14. Prevalence of pain and interference with daily activities and sleep in adults with cerebral palsy**

Elisabet Rodby-Bousquet, Ann Alriksson-Schmidt, Johan Jarl

Dev Med Child Neurol. 2020 Sep 19. doi: 10.1111/dmcn.14678. Online ahead of print.

**Aim:** To analyse the prevalence of pain, pain sites, pain severity, and pain interfering with work or daily activities and sleep in adults with cerebral palsy (CP). **Method:** This was a cross-sectional study based on data from 1591 adults (16-76y, median age 25y; 879 males, 712 females; Communication Function Classification System [CFCS] levels I-V) in the Swedish Cerebral Palsy Follow-up Program. Pain severity was rated for several body sites and pain interference with activities/work and sleep was also evaluated. Logistic regression was used to estimate the odds ratios (ORs) of the factors associated with the prevalence of pain and pain interfering with activities/work or sleep. **Results:** Pain was reported in 1059 of 1591 adults; a higher proportion self-reported pain (69.9%) compared to proxy-reported pain (62.4%). More adults classified in CFCS level I (72.5%) reported pain compared to those in CFCS levels II to V (56.5-64.9%). Adults with severe/very severe pain had a sixfold risk of pain interfering with activity/work (OR=6.68; 95% CI 4.99-8.96) and sleep (OR=6.60; 95% CI 4.84-8.98). **Interpretation:** Two-thirds of adults with CP experienced pain, which is likely to be underreported in individuals who do not communicate efficiently or rely on proxy reports. Pain strongly interfered with activities and sleep; thus, it must be assessed and treated more effectively.

PMID: [32951227](#)

#### **15. Trajectories of psychiatric disorders in a cohort of children with cerebral palsy across four years**

Hanne Marit Bjorgaas, Irene Bircow Elgen, Mari Hysing

Disabil Health J. 2020 Sep 11;100992. doi: 10.1016/j.dhjo.2020.100992. Online ahead of print.

**Background:** Risk of psychiatric disorders has been reported for children and adolescents with cerebral palsy (CP) at different ages, however little is known regarding the long-term trajectories of these disorders. **Objective:** The aim of this study was to assess the trajectories of psychiatric disorders in children with CP, and to explore their association to risk factors. **Methods:** We assessed a cohort of children with CP at age seven and again at age eleven with a child psychiatric diagnostic instrument, and parents were informants. We assessed type of CP, Gross Motor Function Classification System (GMFCS) levels, and co-occurring medical conditions in a medical examination, through the medical records, and in an interview with the parents at the onset of the study. **Results:** We found a significant increase in the prevalence of emotional disorders from seven to eleven years of age ( $p < 0.01$ ), whereas the prevalence of behavioral disorders was stable. Half of the cohort met criteria for a psychiatric disorder at both assessment points. Type of CP, spastic bilateral or unilateral, dyskinetic or ataxic, and co-occurring medical conditions were non-significant predictors of psychiatric disorders. Subthreshold psychiatric disorders at age seven were predictive of psychiatric disorders at age eleven. **Conclusions:** We found a persistently elevated prevalence of psychiatric disorders in children with CP. Prevalence of behavioral disorders was stable, whereas we found a significant four-fold increase in emotional disorders. Sub-threshold psychiatric disorders predicted later psychiatric disorders. Increased focus on early mental health symptoms as well as more knowledge regarding emotional disorders in children with CP seems warranted.

PMID: [32943379](#)

#### **16. AI Approaches Towards Prechtl's Assessment of General Movements: A Systematic Literature Review**

Muhammad Tausif Irshad, Muhammad Adeel Nisar, Philip Gouverneur, Marion Rapp, Marcin Grzegorzec

Review Sensors (Basel). 2020 Sep 17;20(18):E5321. doi: 10.3390/s20185321.

General movements (GMs) are spontaneous movements of infants up to five months post-term involving the whole body

varying in sequence, speed, and amplitude. The assessment of GMs has shown its importance for identifying infants at risk for neuromotor deficits, especially for the detection of cerebral palsy. As the assessment is based on videos of the infant that are rated by trained professionals, the method is time-consuming and expensive. Therefore, approaches based on Artificial Intelligence have gained significantly increased attention in the last years. In this article, we systematically analyze and discuss the main design features of all existing technological approaches seeking to transfer the Prechtl's assessment of general movements from an individual visual perception to computer-based analysis. After identifying their shared shortcomings, we explain the methodological reasons for their limited practical performance and classification rates. As a conclusion of our literature study, we conceptually propose a methodological solution to the defined problem based on the groundbreaking innovation in the area of Deep Learning.

PMID: [32957598](#)

### **17. Mindfulness Improves Brain-Computer Interface Performance by Increasing Control Over Neural Activity in the Alpha Band**

James R Stieger, Stephen Engel, Haiteng Jiang, Christopher C Cline, Mary Jo Kreitzer, Bin He

Cereb Cortex. 2020 Sep 23;bhaa234. doi: 10.1093/cercor/bhaa234. Online ahead of print.

Brain-computer interfaces (BCIs) are promising tools for assisting patients with paralysis, but suffer from long training times and variable user proficiency. Mind-body awareness training (MBAT) can improve BCI learning, but how it does so remains unknown. Here, we show that MBAT allows participants to learn to volitionally increase alpha band neural activity during BCI tasks that incorporate intentional rest. We trained individuals in mindfulness-based stress reduction (MBSR; a standardized MBAT intervention) and compared performance and brain activity before and after training between randomly assigned trained and untrained control groups. The MBAT group showed reliably faster learning of BCI than the control group throughout training. Alpha-band activity in electroencephalogram signals, recorded in the volitional resting state during task performance, showed a parallel increase over sessions, and predicted final BCI performance. The level of alpha-band activity during the intentional resting state correlated reliably with individuals' mindfulness practice as well as performance on a breath counting task. Collectively, these results show that MBAT modifies a specific neural signal used by BCI. MBAT, by increasing patients' control over their brain activity during rest, may increase the effectiveness of BCI in the large population who could benefit from alternatives to direct motor control.

PMID: [32965471](#)

### **18. An Evaluation of Three Kinematic Methods for Gait Event Detection Compared to the Kinetic-Based 'Gold Standard'**

Nicole Zahradka, Khushboo Verma, Ahad Behboodi, Barry Bodt, Henry Wright, Samuel C K Lee

Sensors (Basel). 2020 Sep 15;20(18):E5272. doi: 10.3390/s20185272.

Video- and sensor-based gait analysis systems are rapidly emerging for use in 'real world' scenarios outside of typical instrumented motion analysis laboratories. Unlike laboratory systems, such systems do not use kinetic data from force plates, rather, gait events such as initial contact (IC) and terminal contact (TC) are estimated from video and sensor signals. There are, however, detection errors inherent in kinematic gait event detection methods (GEDM) and comparative study between classic laboratory and video/sensor-based systems is warranted. For this study, three kinematic methods: coordinate based treadmill algorithm (CBTA), shank angular velocity (SK), and foot velocity algorithm (FVA) were compared to 'gold standard' force plate methods (GS) for determining IC and TC in adults ( $n = 6$ ), typically developing children ( $n = 5$ ) and children with cerebral palsy ( $n = 6$ ). The root mean square error (RMSE) values for CBTA, SK, and FVA were 27.22, 47.33, and 78.41 ms, respectively. On average, GED was detected earlier in CBTA and SK (CBTA:  $-9.54 \pm 0.66$  ms, SK:  $-33.41 \pm 0.86$  ms) and delayed in FVA ( $21.00 \pm 1.96$  ms). The statistical model demonstrated insensitivity to variations in group, side, and individuals. Out of three kinematic GEDMs, SK GEDM can best be used for sensor-based gait event detection.

PMID: [32942645](#)

### 19. Development of a community-based, one-stop service centre for children with developmental disorders: changing the narrative of developmental disorders in sub-Saharan Africa

Yetunde Celia Adeniyi, Ade Fatai Adeniyi

Pan Afr Med J. 2020 Jul 8;36:164. doi: 10.11604/pamj.2020.36.164.23402. eCollection 2020.

Sub-Saharan Africa is home to about 15 million children with varying developmental disorders. Services for children with developmental disorders are scarce in Africa. The few available services are limited to the capital cities and are in the private sector, with the cost beyond the reach of most families. In 2016, the Centre for Early Development, Learning and Care was established in Ibadan, South-west, Nigeria. The centre provide services for children with developmental disorders is a one-stop, multidisciplinary team approach. Children are assessed on both structured and unstructured interviews. A total of 584 children were assessed between December 2016 and December 2019. One third (32.4%) of the children assessed within this period met diagnostic criteria for ASD, 29.1% had intellectual disability and 27.6% had cerebral palsy. The remaining clients (10.9%) had other disorders including ADHD, Down's syndrome, hearing impairment and visual impairment. Parents tend to downplay the severity of their children's disability. There are many challenges that are associated with the establishment of a service centre in a low resource setting. These and other experiences are discussed.

PMID: [32952808](#)

### 20. Needs of Families with Children with Cerebral Palsy in Latvia and Factors Affecting These Needs

Dace Bertule, Anita Vetra

J Pers Med. 2020 Sep 22;10(3):E139. doi: 10.3390/jpm10030139.

In order to provide targeted support to families who are raising children with developmental disorders, it is important to study the family needs and to understand circumstances that may affect them. The aim of this study was to identify the needs of the families with preschool children with cerebral palsy, and study how these needs relate to factors associated with families, children and rehabilitation services. Descriptive analysis showed that families living in Latvia most often need information, social and financial support and coordination of services, and they also need financial support to cover the costs of child care and treatment. The results of the data analysis support the hypothesis that factors characterising families, children with cerebral palsy and rehabilitation services affect the needs of the families with preschool children with cerebral palsy living in Latvia, and the unique impact of these factors depends on the type of needs. Regression analysis revealed that the most important factors affecting the needs of families were related with the socio-economic situation, as well as the support of peers and professionals. The availability and regularity of rehabilitation services, limitations to the child's functions and health impairments were factors that affected family needs to a lesser extent.

PMID: [32971768](#)

### 21. Cognitive-Motor Interference Heightens the Prefrontal Cortical Activation and Deteriorates the Task Performance in Children with Hemiplegic Cerebral Palsy

Swati M Surkar, Rashelle M Hoffman, Regina Harbourne, Max J Kurz

Arch Phys Med Rehabil. 2020 Sep 22;S0003-9993(20)30956-4. doi: 10.1016/j.apmr.2020.08.014. Online ahead of print.

Objective: To compare the prefrontal cortex activation (PFC) and task performance during single- and dual-task conditions between typically developing (TD) and children with hemiplegic cerebral palsy (HCP). Design: A prospective, comparative design SETTING: Research lab. Participants: Twelve TD children (Age= 6.0 + 1.1 yrs.) and 9 children with HCP (Age= 7.2 + 3.1 yrs.). Interventions: NA MAIN OUTCOME MEASURE(S): PFC activation was assessed by measuring the concentration of oxygenated hemoglobin (HbO) while the children performed a shape-matching task with their more affected arm while sitting on a stable (single-task) vs. dynamic surface (dual-task). The task performance was assessed with the total number of shapes matched, the dual-task cost and reaction time (RT). Results: For both conditions, the children with HCP exhibited greater PFC activation, matched a fewer shapes, and had slower RT compared with the TD children. These differences were accentuated during the dual-task condition and the dual-task cost was greater. An increase in the PFC activation during the dual-task condition was tightly correlated with a higher dual-task cost in children with HCP ( $r = 0.77$ ;  $p = 0.01$ ). Conclusions:



Children with HCP appear to have a heightened amount of PFC activity while performing a dual-task. The greater cortical activity may be a result of the finite attentional resources that are shared between both the motor as well as cognitive demands of the task. The cognitive-motor interference is likely exacerbated in children with HCP due to the structural and functional brain changes as a result of an insult to the developing brain.

PMID: [32976843](#)

## **22. Evaluation of assessment of caregiver experience with neuromuscular disease: reliability and responsiveness of a new caregiver-reported outcome measure in patients with cerebral palsy**

Nanfang Xu, Hiroko Matsumoto, Joshua Hyman, Benjamin Roye, Heakyung Kim, David P Roye Jr

Transl Pediatr. 2020 Aug;9(4):507-512. doi: 10.21037/tp-19-176.

**Background:** Cerebral palsy (CP) is the most common cause of chronic childhood disability. Caregivers often provide prolonged care over patients' life span, thus measuring the impact of the disease and its treatments on caregivers has become a recent focus in research. The current study aims to present an evaluation of the reliability and responsiveness of assessment of caregiver experience with neuromuscular disease (ACEND) following botulinum toxin injection to relieve spasticity in children with CP. **Methods:** Patients with baseline ACEND scores and at least one assessment following botulinum toxin injection were enrolled. Data on their gender, age, diagnoses, and functional levels (according to The Gross Motor Function Classification System, GMFCS), and ACEND scores were analyzed. Statistical analyses performed included paired t-test and linear regression. **Results:** Baseline ACEND scores (117.7±47.7) were strongly correlated with follow-up scores (120.4±49.5) with a coefficient of 0.929 (P<0.001), suggesting the high reliability of the questionnaire. Paired-sample t-test revealed an insignificant average improvement in ACEND of 2.7 (P=0.352). The ICD-10 code and the GMFCS level were found to be significant predictors for baseline (P=0.043, P<0.001) and follow-up ACEND scores (P=0.025, P<0.001). Male gender was a significant predictor for improvement in ACEND scores. **Conclusions:** We demonstrated the reliability of ACEND through strong correlations of scores before and after botulinum toxin injection. In terms of responsiveness, while the burden of care is largely determined by ICD-10 diagnosis and the GMFCS level, changes in care burden are only related to the gender of the patient and the follow-up time interval.

PMID: [32953548](#)

## **23. Parents' ratings of post-discharge healthcare for their children born very preterm and their suggestions for improvement: a European cohort study**

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Pediatr Res. 2020 Sep 18. doi: 10.1038/s41390-020-01120-y. Online ahead of print.

**Background:** Follow-up of very preterm infants is essential for reducing risks of health and developmental problems and relies on parental engagement. We investigated parents' perceptions of post-discharge healthcare for their children born very preterm in a European multi-country cohort study. **Methods:** Data come from a 5-year follow-up of an area-based cohort of births <32 weeks' gestation in 19 regions from 11 European countries. Perinatal data were collected from medical records and 5-year data from parent-report questionnaires. Parents rated post-discharge care related to their children's preterm birth (poor/fair/good/excellent) and provided free-text suggestions for improvements. We analyzed sociodemographic and medical factors associated with poor/fair ratings, using inverse probability weights to adjust for attrition bias, and assessed free-text responses using thematic analysis. **Results:** Questionnaires were returned for 3635 children (53.8% response rate). Care was rated as poor/fair for 14.2% [from 6.1% (France) to 31.6% (Denmark)]; rates were higher when children had health or developmental problems (e.g. cerebral palsy (34.4%) or epilepsy (36.9%)). From 971 responses, 4 themes and 25 subthemes concerning care improvement were identified. **Conclusions:** Parents' experiences provide guidance for improving very preterm children's post-discharge care; this is a priority for children with health and developmental problems as parental dissatisfaction was high. **Impact:** In a European population-based very preterm birth cohort, parents rated post-discharge healthcare as poor or fair for 14.2% of children, with a wide variation (6.1-31.6%) between countries. Dissatisfaction was reported in over one-third of cases when children had health or developmental difficulties, such as epilepsy or cerebral palsy. Parents' free-text suggestions for improving preterm-related post-discharge healthcare were similar across countries; these focused primarily on better communication with parents and better coordination of care. Parents' lived experiences are a valuable resource for understanding where care improvements are needed and should be included in future research.

PMID: [32947602](#)

#### **24. Early Neurological Assessment and Long-Term Neuromotor Outcomes in Late Preterm Infants: A Critical Review**

Domenico M Romeo, Martina Ricci, Maria Picilli, Benedetta Foti, Giorgia Cordaro, Eugenio Mercuri

Review Medicina (Kaunas). 2020 Sep 15;56(9):E475. doi: 10.3390/medicina56090475.

**Background and Objectives:** Late preterm (LP) infants (born between 34 and 36 weeks of gestational age) are considered at higher risk of neonatal morbidities, mortality, and neurological impairments than full-term born infants (FT). The aim of this study was to provide a critical review of the literature outlining the different aspects of neurological function reported both in the neonatal period and in the follow up of late preterm infants. **Materials and Methods:** A comprehensive search of the MEDLINE, Embase, PsycINFO, and CINAHL electronic databases was made, using the following search terms: 'Late preterm infants', 'Near term infants', 'neurological assessment', 'neurological outcome', 'neuromotor outcome', 'cerebral palsy', 'CP', 'motor impairment', including all the studies reporting clinical neurological assessment of LP (including both neonatal period and subsequent ages). **Results:** A total of 35 articles, comprising 301,495 children, were included as fulfilling the inclusion criteria: ten reported neonatal neurological findings, seven reported data about the first two years after birth, eighteen reported data about incidence of CP and motor disorder during the infancy. Results showed a more immature neurological profile, explored with structured neurological assessments, in LP infants compared with FT infants. The LP population also had a higher risk of developing cerebral palsy, motor delay, and coordination disorder. **Conclusion:** LP had a higher risk of neurological impairments than FT infants, due to a brain immaturity and an increased vulnerability to injury, as the last weeks of gestational age are crucial for the development of the brain.

PMID: [32942722](#)

#### **25. Intravenous paracetamol for neonates: long-term diseases not escalated during 5 years of follow-up**

Sanna Juujärvi, Timo Saarela, Tytti Pokka, Mikko Hallman, Outi Aikio

Arch Dis Child Fetal Neonatal Ed. 2020 Sep 17;fetalneonatal-2020-319069. doi: 10.1136/archdischild-2020-319069. Online ahead of print.

**Objective:** To evaluate the long-term adverse reactions of paracetamol in children who required intensive care shortly after birth. Paracetamol is a widely used analgesic in neonates, but the long-term studies are lacking. Previous epidemiological studies have reported associations between early paracetamol intake and diseases in childhood. **Design:** Five-year follow-up cohort of children who required intensive care shortly after birth. **Setting:** Single tertiary care hospital; neonatal and paediatric intensive care units. **Interventions:** Intravenous paracetamol was administered for pain and discomfort to the neonates during their intensive care, while for the control infants, it was not available. **Main outcome measures:** The primary outcome was the incidence of asthma; secondary outcomes were neonatal diseases and long-term morbidities (atopic dermatitis, inflammatory bowel disease, autism, speech disorders, cerebral palsy). Long-term morbidities were adjusted based on antenatal and neonatal risk factors. **Results:** We screened all neonates admitted to the intensive care units soon after birth in Oulu University Hospital, Oulu, Finland, during 1 October 2007 to 31 December 2013. Altogether, 1552 infants needed intensive care. Of them, 735 (47%) were treated with intravenous paracetamol. We obtained their long-term data from the Finnish National Institute for Health and Welfare, including all physician-made diagnoses from all primary healthcare units and hospitals in Finland. We found no difference in the asthma incidence or in other long-term morbidities between paracetamol-treated and non-exposed infants. **Conclusions:** Intravenous paracetamol given to neonates did not associate with childhood disorders compared with the non-exposed infants during the 5-year follow-up. The previous hypothesis that early paracetamol use causes childhood morbidities was not confirmed.

PMID: [32943529](#)

#### **26. Dyskinesia Impairment Scale scores in Dutch pre-school children after neonatal therapeutic hypothermia**

M J Kuiper, L C Meiners, E S Chandler, R Brandsma, A F Bos, H J Ter Horst, D A Sival, Neonatal neurologic Assessment Group

Eur J Paediatr Neurol. 2020 Aug 5;S1090-3798(20)30158-6. doi: 10.1016/j.ejpn.2020.07.013. Online ahead of print.

**Background:** Neonatal therapeutic hypothermia (TH) can ameliorate or prevent the development of dyskinetic cerebral palsy (CP) after hypoxic-ischemic encephalopathy (HIE). The Dyskinesia Impairment Scale (DIS) was recently launched to quantify dyskinetic (dystonic and choreatic) motor features in patients with CP. In TH treated children, who are at risk of developing dyskinetic CP, we aimed to determine DIS-scores at pre-school age. **Method:** In 21 Dutch pre-school children (3-6 years of age) who had received TH according to the Dutch-Flemish treatment protocol, we determined DIS-scores. We associated DIS-scores with 1. age-matched control values (Kuiper et al., 2018) [1], and 2. previously reported DIS-score range in dyskinetic CP (Monbaliu E et al., 2015). **Results:** The motor phenotype was determined as: normal (n = 18/21), mildly impaired (reduced coordination (n = 2/21)) and abnormal (dyskinetic CP; n = 1/21). In absence of CP (n = 20/21), DIS-scores were lower (more favorable) than in dyskinetic CP, without any overlapping group scores (mean difference: 71 points; p < .05). However, the obtained DIS-scores were still higher than previously reported in healthy age-matched controls (mean difference: 14 points; p < .05). There was an association between DIS-scores and retrospective neonatal MRI (basal ganglia and thalamus injury on diffusion weighted imaging (DWI)) and (a)EEG parameters (p < .05). **Conclusion:** In the vast majority (95%) of Dutch TH-HIE treated pre-school children, the phenotypic motor outcome was favorable. However, DIS-scores were moderately increased compared with healthy age-matched controls. Future studies may elucidate the significance of moderately increased DIS-scores should to further extent.

PMID: [32950367](#)

## 27. Abstracts for the American Academy for Cerebral Palsy and Developmental Medicine 23-26 September 2020

Dev Med Child Neurol. 2020 Sep;62 Suppl 3:4-134. doi: 10.1111/dmcn.14661.

PMID: [32959386](#)

## Prevention and Cure

### 28. Intranasal administration of Cytoglobin modifies human umbilical cord-derived mesenchymal stem cells and improves hypoxic-ischemia brain damage in neonatal rats by modulating p38 MAPK signaling-mediated apoptosis

Hanhua Yang, Shufeng Tian, Lichun Xie, Yunbin Chen, Lian Ma

Mol Med Rep. 2020 Aug 19. doi: 10.3892/mmr.2020.11436. Online ahead of print.

Neonatal hypoxic-ischemic brain damage (HIBD) is a common clinical syndrome in newborns. Hypothermia is the only approved therapy for the clinical treatment; however, the therapeutic window of hypothermia is confined to 6 h after birth and even then, >40% of the infants either die or survive with various impairments, including cerebral palsy, seizure disorder and intellectual disability following hypothermic treatment. The aim of the present study was to determine whether nasal transplantation of Cytoglobin (CYGB) genetically modified human umbilical cord-derived mesenchymal stem cells (CYGB-HuMSCs) exhibited protective effects in neonatal rats with HIBD compared with those treated without genetically modified CYGB. A total of 120 neonatal Sprague-Dawley rats (postnatal day 7) were assigned to either a Sham, HIBD, HuMSCs or CYGB-HuMSCs group (n = 30 rats/group). For HIBD modeling, rats underwent left carotid artery ligation and were exposed to 8% oxygen for 2.5 h. A total of 30 min after HI, HuMSCs (or CYGB-HuMSCs) labeled with enhanced-green fluorescent protein (eGFP) were intranasally administered. After modeling for 3, 14 and 29 days, five randomly selected rats were sacrificed in each group, and the expression levels of CYGB, ERK, JNK and p38 in brain tissues were determined. Nissl staining of the cortex and hippocampal Cornu Ammonis 1 area of rats in each group were compared after 3 days of modeling. TUNEL assay and immunofluorescence were performed 3 days after modeling. Long term memory in rats was assessed using a Morris-water maze 29 days after modeling. The HIBD group demonstrated significant deficiencies compared with the Sham group based on Nissl staining, TUNEL assay and the Morris-water maze test. HuMSC treated rats exhibited improvement on in all the tests, and CYGB-HuMSCs treatment resulted in further improvements. PCR and western blotting results indicated that

the CYGB mRNA and protein levels were increased from day 3 to day 29 after transplantation of CYGB-HuMSCs. Furthermore, it was identified that CYGB-HuMSC transplantation suppressed p38 signaling at all experimental time points. Immunofluorescence indicated the scattered presence of HuMSCs or CYGB-HuMSCs in damaged brain tissue. No eGFP and glial fibrillary acidic protein or eGFP and neuron-specific enolase double-stained positive cells were found in the brain tissues. Therefore, CYGB-HuMSCs may serve as a gene transporter, as well as exert a neuroprotective and antiapoptotic effect in HIBD, potentially via the p38 mitogen-activated protein kinase signaling pathway.

PMID: [32945464](#)