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## Interventions and Management

### **1. Postural asymmetries, pain, and ability to change position of children with cerebral palsy in sitting and supine: a cross-sectional study**

Jackie Casey, Andreas Rosenblad, Elisabet Rodby-Bousquet

Disabil Rehabil. 2020 Nov 3;1-9. doi: 10.1080/09638288.2020.1834628. Online ahead of print.

**Purpose:** To examine any associations between postural asymmetries, postural ability, and pain for children with cerebral palsy in sitting and supine positions. **Methods:** A cross-sectional study of 2,735 children with cerebral palsy, 0-18 years old, reported into the Swedish CPUP registry. Postural asymmetries, postural ability, the gross motor function classification system levels I-V, sex, age and report of pain were used to determine any relationship between these variables. **Results:** Over half the children had postural asymmetries in sitting (n = 1,646; 60.2%) or supine (n = 1,467; 53.6%). These increased with age and as motor function decreased. Children were twice as likely to have pain if they had an asymmetric posture (OR 2.1-2.7), regardless of age, sex and motor function. Children unable to maintain or change position independently were at higher risk for postural asymmetries in both supine (OR 2.6-7.8) and sitting positions (OR 1.5-4.2). **Conclusions:** An association was found between having an asymmetric posture and ability to change position in sitting and/or lying; and with pain. The results indicate the need to assess posture and provide interventions to address asymmetric posture and pain. Implications for rehabilitation Postural asymmetries are present in children with cerebral palsy at all levels of gross motor function. Postural asymmetries increase with age and are associated with pain. Assessment of posture should be included in surveillance programs to enable early detection and treatment.

PMID: [33142069](#)

### **2. A qualitative analysis of the experiences of children with cerebral palsy and their caregivers in a goal-directed cycling programme**

Ellen L Armstrong, Roslyn N Boyd, Christopher P Carty, Megan J Kentish, Benjamin I Goodlich, Sean A Horan

Disabil Rehabil. 2020 Nov 4;1-8. doi: 10.1080/09638288.2020.1839134. Online ahead of print.

**Purpose:** This qualitative thematic analysis aimed to capture the experiences of children with cerebral palsy (CP) and caregivers who completed an 8-week goal-directed cycling programme, to provide insights on engagement and programme feasibility. **Methods:** Children with CP (6-18 years, Gross Motor Function Classification Scale (GMFCS) levels II-IV) and caregivers completed semi-structured interviews at the end of the training programme. Interview transcripts were coded by two investigators and systematically organised into themes. A third investigator reviewed the final thematic map. **Results:** 17 interviews were conducted with 29 participants (11 children: 7-14 years). Four themes emerged: facilitators and challenges to programme engagement; perceived outcomes; the functional-electrical stimulation (FES) cycling experience; and previous cycling participation. Engagement was facilitated by the "therapist's connection," "cycling is fun" and "participant driven goal

setting," while "getting there" and "time off school" were identified as challenges. Participants positively linked improved physical function to greater independence. The FES-experience was "fun and challenging," and participants had mixed feelings about electrode "stickiness." Previous cycling participation was limited by access to adapted bikes. Conclusions: Children with CP enjoy riding bikes. Facilitators and challenges to engagement were identified that hold practical relevance for clinicians. Environmental and personal factors should be carefully considered when developing future programs, to maximise opportunities for success. Clinical trial registration number: Australian New Zealand Clinical Trials Registry - ACTRN12617000644369p **IMPLICATIONS FOR REHABILITATION** Adapted cycling is a fun and engaging activity for young people with cerebral palsy. Environmental and personal factors should be carefully considered when prescribing adapted or FES cycling programs to this group. Engagement in adapted and FES-cycling programs can be facilitated by access to loan equipment, a goal-directed focus, and positive therapist-child relationship. Participation in adapted cycling is limited by access to adapted cycling equipment.

PMID: [33147078](#)

### **3. Long-Term Observational Results from the ASPIRE Study: OnabotulinumtoxinA Treatment for Adult Lower Limb Spasticity**

Alberto Esquenazi, Ganesh Bavikatte, Daniel S Bandari, Wolfgang H Jost, Michael C Munin, Simon Fuk Tan Tang, Joan Largent, Aubrey Manack Adams, Aleksej Zuzek, Gerard E Francisco

PM R. 2020 Nov 5. doi: 10.1002/pmrj.12517. Online ahead of print.

**Introduction:** OnabotulinumtoxinA treatment for spasticity varies according to numerous factors and is individualized to meet treatment goals. **Objective:** Explore real-world onabotulinumtoxinA utilization and effectiveness in patients with lower limb spasticity from the Adult Spasticity International Registry (ASPIRE) study. **Design:** 2-year, multicenter, prospective, observational registry (NCT01930786). **Setting:** 54 international clinical sites. **Patients:** Adults (naïve or non-naïve to botulinum toxin[s] treatment for spasticity, across multiple etiologies) with lower limb spasticity related to upper motor neuron syndrome. **Interventions:** OnabotulinumtoxinA administered at the clinician's discretion. **Main outcome measures:** OnabotulinumtoxinA treatment utilization, clinician- and patient-reported satisfaction. **Results:** In ASPIRE, 530 patients received  $\geq 1$  onabotulinumtoxinA treatment for lower limb spasticity (mean age, 52 years; stroke, 49.4%; multiple sclerosis 20.4%). Equinovarus foot was treated most often (80.9% of patients), followed by flexed knee (26.0%), stiff extended knee (22.5%), and flexed toes (22.3%). OnabotulinumtoxinA doses ranged between 10-1100 U across all presentations. Electromyography (EMG) was most commonly used for injection localization ( $\geq 41.1\%$  of treatment sessions). Despite low patient response on the satisfaction questionnaire, clinicians (94.6% of treatment sessions) and patients (84.5%) reported satisfaction/extreme satisfaction that treatment helped manage spasticity, and clinicians (98.3%) and patients (91.6%) would probably/definitely continue onabotulinumtoxinA treatment. These data should be interpreted with care. 21 adverse events (AEs) in 18 patients (3.4%) were considered treatment-related. 67 patients (12.6%) reported 138 serious AEs; 3 serious AEs in 2 patients (0.4%) were considered treatment-related. No new safety signals were identified. **Conclusions:** ASPIRE provides long-term observational data on the treatment of lower limb spasticity with onabotulinumtoxinA. Real-world data from this primary analysis can help to guide the clinical use of onabotulinumtoxinA to improve spasticity management. This article is protected by copyright. All rights reserved.

PMID: [33151636](#)

### **4. Effect of robot-assisted gait training on motor functions in adolescent and young adult patients with bilateral spastic cerebral palsy: A randomized controlled trial**

Stanislava Klobucká, Robert Klobucký, Branislav Kollár

NeuroRehabilitation. 2020 Oct 29. doi: 10.3233/NRE-203102. Online ahead of print.

**Background:** Robot-assisted gait training (RAGT) allows an intensive gait training in patients with cerebral palsy (CP). There are few evidences on the effectiveness of RAGT in adults with CP. **Objective:** To assess the effect of RAGT on gross motor function in adolescent and adult patients with bilateral spastic CP and to compare the effect of RAGT with conventional kinesiotherapy. **Methods:** Forty-seven patients (mean age  $21.2 \pm 5.33$  years) with bilateral spastic CP were divided into two groups. Twenty-one patients underwent 20 therapeutic units of RAGT and 26 patients underwent 20 therapeutic units of conventional therapy/training (CON). The following parameters were evaluated before (V1) and after the therapy (V2): dimension A (lying and rolling), B (sitting), C (crawling and kneeling), D (standing), E (walking, running and jumping) of the Gross Motor Function Measure (GMFM-88). In patients in the experimental RAGT group, these parameters were also

evaluated 3-4 months later (V3). Results: Comparing the mean improvements in endpoints in both groups (RAGT vs. CON) after 20 TUs, we observed the statistically significant difference ( $p < 0.001$ ) and large effect size in all GMFM dimensions and total GMFM improvement in favour of the RAGT group. In RAGT patients, the improvement persisted even 3-4 months after RAGT ( $p < 0.001$ ). Conclusion: We demonstrated that the intensive RAGT regimen is more effective than conventional therapy in terms of improvements in gross motor functions in adolescent and adult patients with bilateral spastic CP.

PMID: [33136072](#)

### **5. The Effect of Robot-Assisted Gait Training on Locomotor Function and Functional Capability for Daily Activities in Children with Cerebral Palsy: A Single-Blinded, Randomized Cross-Over Trial**

Li Hua Jin, Shin-Seung Yang, Ja Young Choi, Min Kyun Sohn

Brain Sci. 2020 Oct 30;10(11):E801. doi: 10.3390/brainsci10110801.

**Purpose:** The effectiveness of robot-assisted gait training (RAGT) in children with cerebral palsy (CP), especially in terms of improving the performance of daily activities, remains unclear. Therefore, we aimed to investigate the effectiveness of RAGT in children with CP. **Methods:** In this single-center, single-blinded, randomized cross-over trial, we enrolled 20 children with CP with Gross Motor Function Classification System (GMFCS) levels II-IV (13 males; age range,  $6.75 \pm 2.15$  years). The participants were randomized into the RAGT/standard care (SC) ( $n = 10$ ) and SC/RAGT/SC sequence groups ( $n = 10$ ). Using a Walkbot-K system, the RAGT program comprised  $3 \times 30$ -min sessions/week for 6 weeks with a continued SC program. The SC program comprised 2-4 conventional physiotherapy sessions/week for 6 weeks. The Gross Motor Function Measure-88 (GMFM-88), the pediatric functional independence measure (WeeFIM), and the Canadian occupational performance measure (COPM) scores were assessed pre- and post-RAGT or SC periods and treatment, period, follow-up, and carry-over effects were analyzed. Energy expenditure and body composition were measured pre- and post-RAGT. Results: Significant treatment effects were observed in dimensions D and E of the GMFM (D:  $p = 0.018$ ; E:  $p = 0.021$ ) scores, WeeFIM mobility subtotal ( $p = 0.007$ ), and COPM performance ( $p < 0.001$ ) and satisfaction ( $p = 0.001$ ) measure scores. The period, follow-up, and carry-over effects were not statistically significant. The gross energy cost significantly decreased ( $p = 0.041$ ) and the skeletal muscle mass increased ( $p = 0.014$ ) at post-RAGT assessment. The factors associated with functional outcomes showed significant improvements in the GMFM D scores and were mainly observed in children with GMFCS levels II-III compared to those classified at level IV ( $p = 0.038$ ). Conclusion: RAGT had training benefits for children with CP. Specifically, it improved locomotor function and functional capability for daily activities. These effects were better in ambulatory children with CP. However, as SC interventions continued during the RAGT period, these improvements may be also related to multiple treatment effects.

PMID: [33143214](#)

### **6. Functional electrical stimulation cycling, goal-directed training, and adapted cycling for children with cerebral palsy: a randomized controlled trial**

Ellen L Armstrong, Roslyn N Boyd, Sean A Horan, Megan J Kentish, Robert S Ware, Christopher P Carty

Dev Med Child Neurol. 2020 Dec;62(12):1406-1413. doi: 10.1111/dmcn.14648. Epub 2020 Aug 9.

**Aim:** To test the efficacy of functional electrical stimulation (FES) cycling, goal-directed training, and adapted cycling, compared with usual care, to improve function in children with cerebral palsy (CP). **Method:** The intervention was delivered between 2017 and 2019 and included three sessions per week for 8 weeks ( $2 \times 1$ h sessions at a children's hospital, and 1h home programme/week). Hospital sessions included 30 minutes of FES cycling and 30 minutes of goal-directed training. Home programmes included goal-directed training and adapted cycling. The comparison group continued usual care. Primary outcomes were gross motor function assessed by the Gross Motor Function Measure (GMFM) and goal performance/satisfaction assessed using the Canadian Occupational Performance Measure (COPM). Secondary outcomes were sit-to-stand and activity capacity, participation in home, school, and community activities, and power output. Linear regression was used to determine the between-group mean difference immediately post-training completion after adjusting for baseline scores. Results: This randomized controlled trial included 21 participants (mean age=10y 3mo, standard deviation [SD]=3y; Gross Motor Function Classification System level: II=7, III=6, IV=8) who were randomized to the intervention ( $n=11$ ) or usual care group ( $n=10$ ). Between-group differences at T2 favoured the intervention group for GMFM-88 (mean difference=7.4; 95% confidence interval [CI]: 2.3-12.6;  $p=0.007$ ), GMFM-66 (mean difference=5.9; 95% CI: 3.1-8.8;  $p<0.001$ ), COPM performance (mean difference=4.4; 95% CI: 3.9-5.3;  $p<0.001$ ) and satisfaction (mean difference=5.2; 95% CI: 4.0-6.4;

$p < 0.001$ ). Interpretation: Children with CP achieved meaningful functional improvements after FES cycling, goal-directed training, and adapted cycling training. Cycling programmes for children with CP should be individualized and goal directed.

PMID: [33146438](#)

### **7. Management of Rare Causes of Pediatric Chronic Respiratory Failure**

Jenny Shi, Nawal Al-Shamli, Jackie Chiang, Reshma Amin

Review Sleep Med Clin. 2020 Dec;15(4):511-526. doi: 10.1016/j.jsmc.2020.07.002. Epub 2020 Sep 30.

The need for long-term noninvasive positive pressure ventilation (NiPPV) in children with chronic respiratory failure is rapidly growing. This article reviews pediatric-specific considerations of NiPPV therapy. Indications for NiPPV therapy can be categorized by the cause of the respiratory failure: (1) upper airway obstruction, (2) musculoskeletal and/or neuromuscular disease, (3) lower respiratory tract diseases, and (4) control of breathing abnormalities. The role of NiPPV therapy in select rare conditions (spinal muscular atrophy, congenital central hypoventilation syndrome, cerebral palsy, scoliosis, and Chiari malformations) is also reviewed.

PMID: [33131661](#)

### **8. Why individuals with cerebral palsy are at higher risk for respiratory complications from COVID-19**

Joline E Brandenburg, Matthew J Fogarty, Gary C Sieck

Review J Pediatr Rehabil Med. 2020 Oct 15. doi: 10.3233/PRM-200746. Online ahead of print.

Respiratory dysfunction is a leading cause of morbidity and mortality in individuals with cerebral palsy (CP). In children and adults with CP, movement and physical function is always affected. Yet, many clinicians overlook potential for impaired movement and function of the diaphragm muscle (DIAM) in individuals with CP. Since individuals with pre-existing respiratory disorders are at greater risk for respiratory complications if they contract COVID-19, understanding potential risks to individuals with CP is important. In this review we present research on respiratory function and DIAM force generation in children with CP. We compare this clinical work to basic science research investigating phrenic motor neuron and DIAM motor unit dysfunction in an animal model with CP symptoms, the spa mouse. Finally, we integrate the clinical and basic science work in respiratory function in CP, discussing potential for individuals with CP to have severe respiratory symptoms from COVID-19.

PMID: [33136080](#)

### **9. Self-Rated Depressive Symptoms in Children and Youth with and without Cerebral Palsy: A Pilot Study**

Daiki Asano, Masaki Takeda, Satoshi Nobusako, Shu Morioka

Behav Sci (Basel). 2020 Nov 1;10(11):E167. doi: 10.3390/bs10110167.

Children with cerebral palsy (CP) often exhibit mental health problems, such as depressive symptoms. The purpose of this study was to describe the self-rated depressive symptoms in children with and without CP and to investigate the associated predictors. Participants included 24 children with CP and 33 typically developing (TD) children. Depressive symptoms were assessed using the Birlson Depression Self-Rating Scale for Children. Parents of the participants completed the Strengths and Difficulties Questionnaire. Severity of self-rated depressive symptoms was higher in children with CP than that in TD children. Particularly, decline in activities and enjoyment was identified as a contributor to the increased severity of depressive symptoms. Hierarchical multiple regression analysis revealed that the greater severity of depressive symptoms in children with CP was mediated by hyperactivity/inattention and peer problems. Our study suggests that it is imperative to provide opportunities to participate in social activities from an early age.

PMID: [33139599](#)

### 10. Epidural Catheter Placement in Children with Baclofen Pumps

Susan E Eklund, Aneesh V Samineni, Anjali Koka, Bobbie L Riley, Roland R Brusseau, Benjamin J Shore, Patricia E Miller, Scellig S Stone, Charles B Berde, Walid Alrayashi

Paediatr Anaesth. 2020 Nov 1. doi: 10.1111/pan.14061. Online ahead of print.

**Background:** Children with cerebral palsy often suffer from increased tone, which can be treated with intrathecal baclofen via implanted pump. Additionally, they often require major orthopedic surgery for hip reconstruction, however the presence of an intrathecal baclofen pump is a relative contraindication to regional anesthesia due to concerns about damaging the intrathecal baclofen pump system. **Aims:** 1) Evaluate for adverse events related to placing epidural catheters in children with intrathecal baclofen pumps and, 2) describe our multidisciplinary approach to the care of these complex patients. **Methods:** Children with cerebral palsy and intrathecal baclofen pump in situ who underwent hip reconstruction between 2010-2019 and had a perioperative epidural placed were reviewed retrospectively. Charts were assessed for adverse events or ITB complications. Fluoroscopic images were reviewed to evaluate the proximity between epidural and intrathecal baclofen catheters. The process of coordinating multiple services was examined. **Results:** Sixteen children met inclusion criteria. There were no major complications following epidural placement. Postoperative pump interrogation was normal for all patients. Fluoroscopy was utilized for 9/16 (56%) epidural procedures. Epidurogram was used to confirm 11/16 catheters (68%). Children with an intrathecal baclofen pump were identified by orthopedic surgeons at the time of surgical booking and referred to the regional anesthesia team for review. The neurosurgical, pain, and regional anesthesia teams determined the appropriateness and safety of approaching the neuraxis. Pain and/or regional anesthesiologists with competency in spine fluoroscopy were scheduled on the day of surgery for fluoroscopically-guided epidural placement. Postoperatively, catheters were managed by the Acute Pain Team. Intrathecal baclofen pumps were interrogated by the Baclofen Pump Team prior to patient discharge. **Discussion:** In this case series, not only was epidural placement feasible but there were no observed complications. This work highlights the importance of a multidisciplinary approach to complex regional anesthetic techniques, as well as the importance of basic competency in spine fluoroscopy for regional anesthesiologists.

PMID: [33135307](#)

### 11. Distance- and speed-informed kinematics decoding improves M/EEG based upper-limb movement decoder accuracy

Reinmar J Kobler, Andreea I Sburlea, Valeria Mondini, Masayuki Hirata, Gernot R Müller-Putz

J Neural Eng. 2020 Nov 4;17(5):056027. doi: 10.1088/1741-2552/abb3b3.

**Objective:** One of the main goals in brain-computer interface (BCI) research is the replacement or restoration of lost function in individuals with paralysis. One line of research investigates the inference of movement kinematics from brain activity during different volitional states. A growing number of electroencephalography (EEG) and magnetoencephalography (MEG) studies suggest that information about directional (e.g. velocity) and nondirectional (e.g. speed) movement kinematics is accessible noninvasively. We sought to assess if the neural information associated with both types of kinematics can be combined to improve the decoding accuracy. **Approach:** In an offline analysis, we reanalyzed the data of two previous experiments containing the recordings of 34 healthy participants (15 EEG, 19 MEG). We decoded 2D movement trajectories from low-frequency M/EEG signals in executed and observed tracking movements, and compared the accuracy of an unscented Kalman filter (UKF) that explicitly modeled the nonlinear relation between directional and nondirectional kinematics to the accuracies of linear Kalman (KF) and Wiener filters which did not combine both types of kinematics. **Main results:** At the group level, posterior-parietal and parieto-occipital (executed and observed movements) and sensorimotor areas (executed movements) encoded kinematic information. Correlations between the recorded position and velocity trajectories and the UKF decoded ones were on average 0.49 during executed and 0.36 during observed movements. Compared to the other filters, the UKF could achieve the best trade-off between maximizing the signal to noise ratio and minimizing the amplitude mismatch between the recorded and decoded trajectories. **Significance:** We present direct evidence that directional and nondirectional kinematic information is simultaneously detectable in low-frequency M/EEG signals. Moreover, combining directional and nondirectional kinematic information significantly improves the decoding accuracy upon a linear KF.

PMID: [33146148](#)



## 12. A pilot study of the impact of the electro suit Mollii® on body functions, activity and participation in children with Cerebral Palsy

Camilla Flodström, Sari-Anne Wiklund Axelsson, Birgitta Nordström

Assist Technol. 2020 Nov 5. doi: 10.1080/10400435.2020.1837288. Online ahead of print.

Electrical stimulation has been used to treat spasticity in children with cerebral palsy. Building on the benefits of electrical stimulation, a new assistive device, electro-suit Mollii® with imbedded electrodes has been tested. The aim of the study was to evaluate the possible effect of Mollii® on body function, activity and participation in self-selected activities. Methods: Six children, five to ten years of age, used the electro-suit for one hour, every other day for three months. The impact was evaluated after four weeks and after three months by measuring passive range of motion (ROM), muscle tone, pain, gross motor function and participation. Results: All participants improved in the total score for Canadian Occupational Performance Measure (COPM), three of them showed significant clinical improvements. Pain was reduced for children who estimated pain when the study started. There were also small changes in ROM and muscle tone and gross motor function. Conclusion: Electro-suit Mollii® had a positive impact on activity and participation in self-selected activities among the children in this study. Further studies with more children over a longer time are necessary to evaluate the impact and usefulness over time.

PMID: [33151822](#)

## 13. Lateralized EEG mu power during action observation and motor imagery in typically developing children and children with unilateral Cerebral Palsy

Marijtje L A Jongsma, Bert Steenbergen, C Marjolein Baas, Pauline B Aarts, Clementina M van Rijn

Clin Neurophysiol. 2020 Oct 13;131(12):2829-2840. doi: 10.1016/j.clinph.2020.08.022. Online ahead of print.

Objective: During motor execution (ME), mu power is diminished over the contralateral hemisphere and increased over the ipsilateral hemisphere, which has been associated with cortical activation of the contralateral motor areas and inhibition of the ipsilateral motor areas respectively. The influence of action observation (AO) and motor imagery (MI) on mu power is less clear, especially in children, and remains to be studied in children with unilateral cerebral palsy (uCP). Methods: We determined mu power during ME, AO, and MI of 45 typically developing (TD) children and 15 children with uCP over both hemispheres, for each hand. Results: In TD children, over the left hemisphere mu power was lowered during ME when the right hand was used. In line, over the right hemisphere mu power was lowered when the left hand was addressed. In addition, during AO and MI increased mu power was observed when the right hand was addressed. In children with uCP, over the spared hemisphere mu power was diminished during ME when the less-affected hand was used. However, over the lesioned hemisphere, no mu changes were observed. Conclusions: The results of TD children fit the activation/inhibition model of mu power. Significance: The results of children with uCP suggest that the lesioned hemisphere is unresponsive to the motor tasks.

PMID: [33152523](#)

## 14. Virtual reality and non-invasive brain stimulation for rehabilitation applications: a systematic review

Raymundo Cassani, Guilherme S Novak, Tiago H Falk, Alcyr A Oliveira

Review J Neuroeng Rehabil. 2020 Oct 31;17(1):147. doi: 10.1186/s12984-020-00780-5.

The present article reports the results of a systematic review on the potential benefits of the combined use of virtual reality (VR) and non-invasive brain stimulation (NIBS) as a novel approach for rehabilitation. VR and NIBS are two rehabilitation techniques that have been consistently explored by health professionals, and in recent years there is strong evidence of the therapeutic benefits of their combined use. In this work, we reviewed research articles that report the combined use of VR and two common NIBS techniques, namely transcranial direct current stimulation (tDCS) and transcranial magnetic stimulation (TMS). Relevant queries to six major bibliographic databases were performed to retrieve original research articles that reported the use of the combination VR-NIBS for rehabilitation applications. A total of 16 articles were identified and reviewed. The reviewed studies have significant differences in the goals, materials, methods, and outcomes. These differences are likely caused by the lack of guidelines and best practices on how to combine VR and NIBS techniques. Five therapeutic applications were identified: stroke, neuropathic pain, cerebral palsy, phobia and post-traumatic stress disorder, and multiple sclerosis rehabilitation. The majority of the reviewed studies reported positive effects of the use of VR-NIBS. However, further research is still needed to validate existing results on larger sample sizes and across different clinical conditions. For these reasons, in

this review recommendations for future studies exploring the combined use of VR and NIBS are presented to facilitate the comparison among works.

PMID: [33129331](#)

### **15. The association between maternal exposure to secondhand smoke during pregnancy and their children's cerebral palsy, Shandong, China**

Songtao Ren, Shaohua Xie, Xuri Li, Guofeng Li, Yan Wang, Weidong Liu, Li Wang

Tob Induc Dis. 2020 Oct 21;18:87. doi: 10.18332/tid/127872. eCollection 2020.

**Introduction:** Tobacco use poses a threat to the health of pregnant women and their children. Our study assessed the association between maternal exposure to secondhand smoke (SHS) during pregnancy and children's cerebral palsy (CP) in Shandong, China. **Methods:** In our observational study, 5067 mother-child pairs were included from Shandong Province, China. Mothers filled in questionnaires about exposure to SHS during pregnancy. Statistical analysis and logistic regression models were built in R program to estimate the association in adjusted odds ratio (AOR) between SHS exposure during pregnancy and risk of children's CP, after adjustment for potential confounders including delivery mode and baby's birthweight. **Results:** Exposure to SHS was noted among 3663 (72.3%) of the 5067 non-smoking mothers during their pregnancy. Of the 239 CP children within the study, 192 (80.3%) were exposed to SHS during pregnancy. Children born to mothers exposed to SHS during pregnancy had a higher risk of CP (AOR=1.44; 95% CI: 1.02-2.04) than those born to non-exposed mothers, the risk increased by exposure time in the logistic regression model. The association between SHS exposure during pregnancy and CP children remained significant when adjusting for delivery mode and infant's birthweight due to their significant association with CP, with an AOR of 1.46 (95% CI: 1.13-1.91) for 1-4 days/week and 1.63 (95% CI: 1.22-2.01) for 5-7 days/week exposure to SHS. **Conclusions:** Our study suggests that maternal exposure to secondhand smoke during pregnancy is associated with children's CP. Future preventive interventions of CP should include strategies that target the antenatal women who are exposed to SHS.

PMID: [33132801](#)

### **16. Neuroimaging patterns of anatomical features in pediatric cerebral palsy patients at Ayder hospital, Mekelle, Ethiopia**

Peter Etim Ekanem, Anne Caroline Kendi Nyaga, Elizabeth Akitsa Imbusi, Regina Ekanem, Berhanu Mebrahte, Adhanom Gebreslasie, Nissi Peter

PLoS One. 2020 Nov 4;15(11):e0241436. doi: 10.1371/journal.pone.0241436. eCollection 2020.

**Background:** Neuroradiological studies have greatly improved the knowledge and diagnoses of cerebral palsy with its underlying pathology, types and accompanying changes in brain morphology. However, there is no published study on cerebral palsy neuroimaging patterns in Ethiopia. **Methods:** Retrospective chart and neuroimaging reviews were conducted among pediatric patients, who attended Ayder Comprehensive Specialized Hospital between January 2016 and August 2019, fulfilling the study criteria. The magnetic resonance images and computed tomography scans reviewed by a neuroradiologist and/or pediatric neurologist were included. Data was collected using a structured checklist and analyzed using SPSS statistical software version 22. Results were represented using tables, graphs and images. **Results:** The median age at neuroimaging was 2 years. There were more males (54.5%) than females (45.5%) with a male: female ratio of 1.2:1. Majority of the patients had magnetic resonance (81.8%) as opposed to computed tomography scans (18.2%). Most of the patients (69.7%) had been born at term with spastic quadriplegia (33.3%) found to be the leading type of cerebral palsy. 30.3% of the patients had normal neuroimaging studies whereas 69.7% had neuroimaging abnormalities. Anomalies included pathologies of the white matter (18.2%), basal ganglia (15.2%), cortex and lobes (27.3%), corpus callosum (6.1%), lateral ventricles (12.1%), cysts (18.2%) and cerebellum (3%), respectively. Other findings were seen in 45.5% of the patients. **Conclusion:** Severe forms of cerebral palsy (spastic quadriplegia) were most common with majorly cortical and subcortical brain involvement.

PMID: [33147254](#)

### **17. Experiences and Needs of Parents Caring for Children with Cerebral Palsy: A Systematic Review**

Ian Thiruchelvam Elangkovan, Shefaly Shorey

J Dev Behav Pediatr. 2020 Oct 27. doi: 10.1097/DBP.0000000000000880. Online ahead of print.

**Objective:** Caregiver burden of parents of children with disabilities is negatively associated with parental quality of life and psychosocial well-being and has been identified as a public health concern. Reviews have consolidated the experiences of these parents, but little is understood about the unique challenges faced by parents of children with cerebral palsy (CP). We aim to conduct an in-depth synthesis of the experiences and needs of parents of children with CP to better support them. **Methods:** Six electronic databases were searched systematically for qualitative research, and a thematic synthesis was performed. **Results:** Seventeen studies from 1988 to 2019 encapsulating the experiences of 226 parents were included in this review. Four themes and 11 subthemes were identified: (1) self: the caregiver-parent trajectory (coming to terms with the fact, physical and emotional demands, and a nice outlet), (2) family: maintaining the family unit (juggling multiple children and parenting as a co-occupation), (3) society: social repercussions (facing public discrimination, rejection by extended family, and loss of freedom), and (4) parents' wish list (open communication and caring attitudes, funding and health care accessibility, social integration, and inclusivity). Apart from emotional adaptation and physical childcare difficulty, parents indicated a need for more information on health care services, funding, better attitudes and empathy from health care providers, properly trained educators, disability-friendly fixtures, and more public awareness. **Conclusion:** The findings in this review provide insight into the true experiences and needs of parents caring for children with CP and will aid clinicians in the development of family-centered care pathways for these patients.

PMID: [33136702](#)

### **18. Gynecological Care and Contraception Considerations in Women with Cerebral Palsy**

Madeline Fasen, Brittany Saldivar, Suhane Elamsenthil, Jordan Thompson, Lina Fouad, Linda Edwards, Rafik Jacob

South Med J. 2020 Nov;113(11):549-552. doi: 10.14423/SMJ.0000000000001170.

The purpose of this literature review was to further explore gynecological care and contraceptive use in women with cerebral palsy. We address barriers to pelvic examinations for cervical cancer screenings and current contraceptive methods in severely debilitated patients with cerebral palsy.

PMID: [33140107](#)

### **19. Enhancing early detection of neurological and developmental disorders and provision of intervention in low-resource settings in Uttar Pradesh, India: study protocol of the G.A.N.E.S.H. programme**

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**Introduction:** Around 9% of India's children under six are diagnosed with neurodevelopmental disorders. Low-resource, rural communities often lack programmes for early identification and intervention. The Prechtl General Movement Assessment (GMA) is regarded as the best clinical tool to predict cerebral palsy in infants <5 months. In addition, children with developmental delay, intellectual disabilities, late detected genetic disorders or autism spectrum disorder show abnormal general movements (GMs) during infancy. General Movement Assessment in Neonates for Early Identification and Intervention, Social Support and Health Awareness (G.A.N.E.S.H.) aims to (1) provide evidence as to whether community health workers can support the identification of infants at high-risk for neurological and developmental disorders and disabilities, (2) monitor further development in those infants and (3) initiate early and targeted intervention procedures. **Methods:** This 3-year observational cohort study will comprise at least 2000 infants born across four districts of Uttar Pradesh, India. Community health workers, certified for GMA, video record and assess the infants' GMs twice, that is, within 2 months after birth and at 3-5 months. In case of abnormal GMs and/or reduced MOSs, infants are further examined by a paediatrician



and a neurologist. If necessary, early intervention strategies (treatment as usual) are introduced. After paediatric and neurodevelopmental assessments at 12-24 months, outcomes are categorised as normal or neurological/developmental disorders. Research objective (1): to relate the GMA to the outcome at 12-24 months. Research objective (2): to investigate the impact of predefined exposures. Research objective (3): to evaluate the interscorer agreement of GMA. Ethics and dissemination: G.A.N.E.S.H. received ethics approval from the Indian Government Chief Medical Officers of Varanasi and Mirzapur and from the Ramakrishna Mission Home of Service in Varanasi. GMA is a worldwide used diagnostic tool, approved by the Ethics Committee of the Medical University of Graz, Austria (27-388 ex 14/15). Apart from peer-reviewed publications, we are planning to deploy G.A.N.E.S.H. in other vulnerable settings.

PMID: [33148727](#)

**20. The general movement checklist: A guide to the assessment of general movements during preterm and term age**  
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Objectives: To develop a checklist describing features of normal and abnormal general movements (GMs) in order to guide General Movement Assessment (GMA) novices through the assessment procedure, to provide a quantification of GMA; and to demonstrate that normal and abnormal GMs can be distinguished on the basis of a metric checklist score. Methods: Three examiners used GMA and the newly developed GM checklist to assess 20 videos of 16 infants (seven males) recorded at 31-45 weeks postmenstrual age (writhing GMs). Inter- and intra-scorer agreement was determined for GMA (nominal data; Kappa values) and the checklist score (metric scale ranging from 0 to 26; Intraclass Correlation - ICC - values). The scorers' satisfaction with the usefulness of the checklist was assessed by means of a short questionnaire (score 10 for maximum satisfaction). Results: The scorers' satisfaction ranged from 8.44 to 9.14, which indicates high satisfaction. The median checklist score of the nine videos showing normal GMs was significantly higher than that of the eleven videos showing abnormal GMs (26 vs. 11,  $p < 0.001$ ). The checklist score also differentiated between poor-repertoire (median = 13) and cramped-synchronized GMs (median = 7;  $p = 0.002$ ). Inter- and intra-scorer agreement on (i) normal vs. abnormal GMs was good to excellent (Kappa = 0.68-1.00); (ii) the distinction between the four GM categories was considerable to excellent (Kappa = 0.56-0.93); (iii) the checklist was good to excellent (ICC = 0.77-0.96). Conclusion: The GM checklist proved an important tool for the evaluation of normal and abnormal GMs; its score may potentially document individual trajectories and the effect of therapeutic intervention.

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**21. Neuromotor Development Evaluation of Preterm Babies Less than 34 Weeks of Gestation with Bayley III at 18-24 Months**

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Objectives: To assess and evaluate the risk factors affecting the neuromotor development of preterm babies at corrected age 18 to 24 months. Methods: Preterm babies  $\leq 34$  weeks of gestational age (GA) who were born in our hospital between 2011 and 2014 were prospectively included in the study. Prenatal, perinatal, and postnatal features of the babies were recorded. Bayley Scales of Infants and Toddler Development, Third Edition (Bayley-III), was applied at corrected age 18 to 24 months. Results: All data of 96 babies were obtained during the study, mean birth weight was  $1542 \pm 518$  g, and mean corrected age was  $20.9 \pm 4.7$  months. Cerebral palsy was found in 11 babies (11.5%). According to Bayley III scores, 13.5% cognitive delay, 19.8% language delay, and 33.3% motor delay rations were detected. A positive correlation was found between GA and motor composite scores ( $p = 0.011$ ). The mean motor composite score was lower in babies with the Apgar score less than 7 at 1st and 5th minutes ( $p = 0.007$  and  $p = 0.003$ ) and applied resuscitation in the delivery room ( $p = 0.033$ ). The mean language composite score was found to be higher in babies with antenatal steroid administration ( $p = 0.003$ ). A negative correlation was found between the motor composite score and the oxygen treatment time and mechanical ventilation support time ( $p = 0.001$  and  $p = 0.007$ ). Conclusion: In preterm babies less than 34 weeks, the birth weight, GA, Apgar score, oxygen treatment time, mechanical ventilation support time, and resuscitation in a delivery room were determined to affect the Bayley III motor score. Language development was found better in babies with antenatal steroid administration.

PMID: [33145354](#)

## 22. Perinatal Arterial Ischemic Stroke

Gavin D Roach

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Perinatal arterial ischemic stroke (PAIS) is a common cause of seizures, encephalopathy, altered mental status, and focal neurologic deficits in the neonatal period. It is the leading known cause of cerebral palsy. Other long-term risks include the development of epilepsy and impairment in cognition, language, and behavior. This article will review the known risk factors for PAIS, as well as the evaluation, management, and prognosis. Long-term neurodevelopmental surveillance is recommended, along with intensive therapies to reduce morbidity.

PMID: [33139511](#)

## 23. Neutrophil-to-lymphocyte ratio predicts the severity of motor impairment in cerebral palsy children living at home and the rehabilitation center: A comparative study

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The aim of the present study was to investigate the neutrophil-to-lymphocyte ratio (NLR) level in children with cerebral palsy (CP) living at home or the rehabilitation center. The correlation of NLR with different severities of motor impairment was assessed. This was a single-center, cross-sectional, observational study. A total of 80 CP children who were either living at home (n=34) or at the rehabilitation center (n=46) were included. Demographic characteristics, anthropometric parameters and complete blood counts were recorded, and the NLR values were calculated. The severity of motor impairment was evaluated and categorized according to the Gross Motor Functional Classification System (GMFCS) level. The mean age of CP participants was 8.52±1.92 years. The percentage of children with CP who were malnourished (underweight, stunted and wasted) was higher amongst those at the rehabilitation center compared with those living at home. The mean NLR of children with CP in the rehabilitation center was significantly higher compared with the patients living at home (P=0.003). Participants from the rehabilitation center had severe motor impairment (GMFCS levels IV-V) and significantly higher NLR values than those with mild motor impairments (GMFCS levels II-III; P=0.006). However, there were no differences in NLR values in relation to severity of motor impairment in CP children living at home. CP children had some degree of neuroinflammation and systemic inflammation. NLR may be a potential simple inflammatory parameter that may be used to predict the severity of the motor impairment, particularly in CP children living at a rehabilitation center.

PMID: [33149907](#)

## 24. Feasibility of remote transcranial direct current stimulation for pediatric cerebral palsy during the COVID-19 pandemic

Daniel H Lench, Emma Simpson, Ellen N Sutter, Bernadette T Gillick

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PMID: [33132132](#)