

Monday 23 July 2018

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Interventions and Management

1. The Two-Arm Coordination Test: Maturation of Bimanual Coordination in Typically Developing Children and Deficits in Children with Unilateral Cerebral Palsy.

Riquelme I, Arnould C, Hatem SM, Bleyenheuft Y.

ev Neurorehabil. 2018 Jul 19:1-9. doi: 10.1080/17518423.2018.1498552. [Epub ahead of print]

Tools to assess bimanual coordination are scant. We aimed to: 1) provide normative data of maturation of bimanual coordination in typically developing (TD) children measured by the Two Arm Coordination Test (TACT), and 2) validate the TACT as an instrument to specifically discriminate impairment of bimanual coordination in children with unilateral cerebral palsy (UCP). Cross-sectional observational study. 252 TD children and 26 children with UCP performed 8 trials of TACT (following a star pattern with a pointer steered by coordinated movements of both arms). Number of errors and time were combined in a performance index of motor learning. In TD children, bimanual coordination improved with age ($F(7,244) = 36.888, p < .001$). Children with UCP had a poorer bimanual coordination than TD children (all $t > 24.25$, all $p < .01$). TACT scores were correlated moderately to manual dexterity and manual ability (all $r > .452$, all $p < .039$), showing the capacity of the TACT to provide information on different aspects of hand function. TACT is a valid instrument to assess bimanual coordination.

[PMID: 30024779](#)

2. Evaluation of a toolkit for standardizing clinical measures of muscle tone.

McGibbon CA, Sexton A, Hughes G, Wilson A, Jones M, O'Connell C, Parker K, Adans-Dester C, O'Brien A, Bonato P.

Physiol Meas. 2018 Jul 18. doi: 10.1088/1361-6579/aad424. [Epub ahead of print]

To evaluate a new portable toolkit for quantifying upper and lower extremity muscle tone in patients with upper motor neuron syndrome (UMNS); Design: Cross-sectional, multi-site, observational trial to test and validate a new technology; Setting: Neurorehabilitation clinics at tertiary care hospitals; Participants: Four cohorts UMNS patient, >6mo post acquired brain injury, spinal cord injury, multiple sclerosis and cerebral palsy, and a sample of healthy age-matched adult controls; Measures: Strength: grip, elbow flexor and extensor, and knee extensor; Range of Motion (ROM): Passive ROM (contracture) and passive-active ROM (paresis); Objective spasticity: Stretch-reflex test for elbow, and pendulum test for knee; Subjective spasticity: Modified Ashworth Scale scores for elbow and knee flexors and extensors; Results: Measures were acquired for 103 patients from three rehabilitation clinics. Results for patient cohorts were consistent with the literature. Grip strength correlated significantly with elbow muscle strength and all patient populations were significantly weaker in upper- and lower-extremity compared to controls. Strength and paresis were correlated for elbow and knee but neither correlated with contracture. Elbow spasticity correlated with strength and paresis but not contracture. Knee spasticity correlated with strength, and subjective spasticity correlated with contracture; Conclusions: The BioTone™ toolkit provided comprehensive objective measures for assessing muscle tone in patients with UMNS. The toolkit could be useful for standardizing outcomes measures in clinical trials and for routine practice.

[PMID: 30019689](#)

3. Feasibility and safety of shared EEG/EOG and vision-guided autonomous whole-arm exoskeleton control to perform activities of daily living.

Sci Rep. 2018 Jul 17;8(1):10823. doi: 10.1038/s41598-018-29091-5.

Crea S, Nann M, Trigili E, Cordella F, Baldoni A, Badesa FJ, Catalán JM, Zollo L, Vitiello N, Aracil NG, Soekadar SR.

Arm and finger paralysis, e.g. due to brain stem stroke, often results in the inability to perform activities of daily living (ADLs) such as eating and drinking. Recently, it was shown that a hybrid electroencephalography/electrooculography (EEG/EOG) brain/neural hand exoskeleton can restore hand function to quadriplegics, but it was unknown whether such control paradigm can be also used for fluent, reliable and safe operation of a semi-autonomous whole-arm exoskeleton restoring ADLs. To test this, seven abled-bodied participants (seven right-handed males, mean age 30 ± 8 years) were instructed to use an EEG/EOG-controlled whole-arm exoskeleton attached to their right arm to perform a drinking task comprising multiple sub-tasks (reaching, grasping, drinking, moving back and releasing a cup). Fluent and reliable control was defined as average 'time to initialize' (TTI) execution of each sub-task below 3 s with successful initializations of at least 75% of sub-tasks within 5 s. During use of the system, no undesired side effects were reported. All participants were able to fluently and reliably control the vision-guided autonomous whole-arm exoskeleton (average TTI 2.12 ± 0.78 s across modalities with 75% successful initializations reached at 1.9 s for EOG and 4.1 s for EEG control) paving the way for restoring ADLs in severe arm and hand paralysis.

[PMID: 30018334](#)

4. Effectiveness of virtual reality in the treatment of hand function in children with cerebral palsy: A systematic review.

Rathinam C, Mohan V, Peirson J, Skinner J, Nethaji KS, Kuhn I.

J Hand Ther. 2018 Jul 13. pii: S0894-1130(17)30107-2. doi: 10.1016/j.jht.2018.01.006. [Epub ahead of print]

Systematic review. Children with cerebral palsy (CP) may have limited use of their hands for functional activities and for fine motor skills. Virtual reality (VR) is a relatively new and innovative approach to facilitate hand function in children with CP. The primary purpose of this study was to determine the effectiveness of VR as an intervention to improve hand function in children with CP compared to either conventional physiotherapy or other therapeutic interventions. The secondary purpose was to classify the outcomes evaluated according to the International Classification of Functioning, Disability and Health (ICF) dimensions. A International prospective register of systematic reviews (PROSPERO)-registered literature search was carried out in August 2015 in MEDLINE, CINAHL, ERIC, HealthSTAR, AMED, BNI, Embase, PsycINFO, PEDro, Cochrane Central Register, DARE, OTSeeker, REHABDATA, HaPI, CIRRIE, and Scopus. PRISMA guidelines were followed. Only randomized controlled trials (RCTs) were included, and their methodological qualities were examined using the Cochrane collaboration's risk of bias (RoB) tool. A narrative synthesis was performed. The 6 RCTs published on this topic provide conflicting results. Four studies reported improved hand function (2 low RoB, 1 high RoB, and 1 unclear RoB), whereas 2 studies reported no improvement. All of the RCTs reported the activity element of ICF, but no study explicitly described the effect of VR intervention based on the ICF model. The role of VR to improve hand function in children with CP is unclear due to limited evidence; use as an adjunct has some support.

[PMID: 30017414](#)

5. Preferred posture in lying and its association with scoliosis and windswept hips in adults with cerebral palsy.

Ágústsson A, Sveinsson T, Pope P, Rodby-Bousquet E.

Disabil Rehabil. 2018 Jul 16:1-5. doi: 10.1080/09638288.2018.1492032. [Epub ahead of print]

The aim of this study was to clarify the association of scoliosis and windswept hips with immobility, lying position, and time in lying, in adults with cerebral palsy (CP). This cross-sectional study included 830 adults (469 males and 361 females) with a diagnosis of CP, 16-73 years, and classified at levels I-V according to the Gross Motor Function Classification System (GMFCS). Subjects' Gross motor function classification system level, presence and severity of scoliosis, hip and knee joint range of movement, lying position, postural ability in lying, and time in lying were used to identify connections between them. Adults who are immobile in the lying position have higher odds of both scoliosis and windswept hips. Spending more than 8 h daily in the same lying position, increased the odds of having scoliosis, while lying solely in a supine position, resulted in higher odds of windswept hips. The "preferred" habitual posture frequently observed in immobile adults with CP, leads to established distortion of their body shape. The results indicate the need for early introduction of appropriate posture control, in immobile individuals with CP, from a young age. Implications for rehabilitation. The preferred posture, observed in immobile adults with cerebral palsy, leads to a distortion of their body shape. One in four adults with cerebral palsy use only one position when in bed. The results indicate the need for early introduction of appropriate posture control in individuals unable to change position.

[PMID: 30010440](#)

6. Reliability, construct validity and usability of the Eating and Drinking Ability Classification System (EDACS) among Dutch children with Cerebral Palsy.

van Hulst K, Snik DAC, Jongerius PH, Sellers D, Erasmus CE, Geurts ACH.

J Pediatr Rehabil Med. 2018;11(2):115-124. doi: 10.3233/PRM-170515.

To assess the interrater reliability, construct validity and usability of the Eating and Drinking Ability Classification System (EDACS) among Dutch children with Cerebral Palsy (CP) when used by speech and language therapists (SLTs) familiar and unfamiliar with the child's eating and drinking performance and parents. Translation was undertaken using the method of Eremenco. Agreement between SLTs and parents when using EDACS was determined by intraclass correlation coefficient (ICC) and linear weighted Kappa (κ W). Associations with other functional classification systems including the Dysphagia Management Staging Scale (DMSS) were investigated to determine construct validity by Kendall's tau-b. Thirty-one SLTs classified 149 children (67 girls; mean 10 y, SD 4 y, range 3-21 y) with EDACS. Pairs of SLTs showed good agreement ([ICC] = 0.84; 95% confidence interval [CI] 0.79-0.88; [κ W] = 0.71). Eighty-one parents showed good agreement with SLTs (n= 31) as well (ICC = 0.80; 95% CI 0.71-0.87; κ W= 0.61). There was a significant and strong positive correlation of EDACS with DMSS (Kendall's tau-b 0.81) supporting its construct validity. Usability of EDACS was generally good. The Dutch version of EDACS is reliable and valid, and can be used easily by (familiar and unfamiliar) SLTs and parents of children with CP. Parents and professionals showed a high level of consistency when classifying eating and drinking abilities. EDACS enables uniform and efficient communication about safety and efficiency of functional eating and drinking ability in clinical and research contexts.

[PMID: 30010151](#)

7. Does virtual reality training using the Xbox Kinect have a positive effect on physical functioning in children with spastic cerebral palsy? A case series.

Jung SH, Song SH, Kim SD, Lee K, Lee GC.

J Pediatr Rehabil Med. 2018;11(2):95-101. doi: 10.3233/PRM-160415.

The present study investigated the effects of virtual reality (VR) training using the Xbox Kinect on motor function, balance, gait, and functional mobility in children with cerebral palsy (CP). This was a case series. Four children with spastic diplegic cerebral palsy were provided VR training using the Xbox Kinect for 12 sessions (three sessions per week for 4 weeks). At baseline and follow-up, physical function was measured using the following: Selective Motor Control (SMC) for motor function, Pediatric Balance Scale (PBS) for balance, Timed Up and Go (TUG) test and Functional Mobility Scale (FMS) for functional mobility, and 6-meter walk test (6WT) for gait. As compared with the baseline scores, SMC, PBS, TUG, FMS, and 6MWT scores after training showed improvements. In participant 1, PBS and TUG scores improved after VR training. In participant 2, SMC (left ankle dorsiflexor, left knee extensor), PBS, TUG, and FMS scores improved after training. In participant 3, SMC (left hip flexor), TUG, FMS, and 6MWT scores improved after training. In participant 4, SMC (right ankle dorsiflexor), PBS, TUG, FMS, and 6MWT scores improved after training. The results show that VR training using the Xbox Kinect may improve physical functioning in children with spastic diplegic cerebral palsy. However, its utility in the rehabilitation of children with CP requires further investigation.

[PMID: 30010148](#)

8. Intrathecal Baclofen Therapy-Practical Approach: Clinical Benefits and Complication Management.

Winter G, Beni-Adani L, Ben-Pazi H.

J Child Neurol. 2018 Jan 1:883073818785074. doi: 10.1177/0883073818785074. [Epub ahead of print]

Intrathecal baclofen is an expanding accepted treatment for children with cerebral palsy and other causes of spasticity and dystonia. The aims of this review are therefore to (1) delineate the clinical benefits of intrathecal baclofen therapy in pediatric spasticity and dystonia and (2) increase awareness of the potential complications and emergency management measures of intrathecal baclofen therapy. A current literature review demonstrates the benefits and complications of this minimally invasive device. Practical guides for recognizing acute conditions and management recommendations are included. Intrathecal baclofen is increasingly being used to help individuals attain realistic functional goals. Therefore, families and health care professionals should be aware of potential complications, symptoms, and emergency management.

[PMID: 30009656](#)

9. Signs of spasticity during walking in children with spastic cerebral palsy.

Bjølseth A, Brændvik SMB, Roeleveld K.

Gait Posture. 2018 Jul 2. pii: S0966-6362(18)31002-6. doi: 10.1016/j.gaitpost.2018.06.216. [Epub ahead of print]
[PMID: 30007494](#)

10. Working towards an objective segmental assessment of trunk control in children with cerebral palsy.

Sánchez MB, Loram I, Holmes P, Darby J, Butler PB.

Gait Posture. 2018 Jun 30;65:45-50. doi: 10.1016/j.gaitpost.2018.06.176. [Epub ahead of print]

Physical therapy evaluations of motor control are currently based on subjective clinical assessments. Despite validation, these can still be inconsistent between therapists and between clinics, compromising the process of validating a therapeutic intervention and the subsequent generation of evidence-based practice (EBP) guidelines. EBP benefits from well-defined objective measurements that complement existing subjective assessments. The aim of this study was to develop an objective measure of head/trunk control in children with Cerebral Palsy (CP) using previously developed video-based methods of head/trunk alignment and absence of external support and compare these with the existing subjective Segmental Assessment of Trunk Control (SATCo). Twelve children with CP were recruited and an average of 3 (± 1.1) SATCo tests performed per child. The full SATCo was concurrently video-recorded from a sagittal view; markers were placed on specific landmarks of the head, trunk and pelvis to track and estimate head/trunk segment position. A simplified objective rule was created for control and used on videos showing no external support. This replicated the clinical parameters and enabled identification of the segmental-loss-of-control. The subjectively and objectively identified segmental-loss-of-control were compared using a Pearson Correlation Coefficient. An angular-threshold of 17° from alignment showed the minimum bias between the subjectively and the objectively measured segmental-loss-of-control (mean error = -0.11 and RMSE = 1.5) and a significant correlation ($r = 0.78$, $r^2 = 0.61$, $p < .01$). This study showed that simple objective video-based measurements can be used to reconstruct the subjective assessment of segmental head/trunk control. This suggests that a clinically-friendly video-based objective measure has future potential to complement subjective assessments and to assist in the generation of EBP guidelines. Further development will increase the information that can be extracted from video images and enable generation of a fully automated objective measure.
[PMID: 30007222](#)

11. Center of pressure progression and ground reaction forces are altered in cerebral palsy crouch gait.

Salehi A, Khandan A, Arab Baniasad M, Baghdadi S, Farahmand F, Zohoor H.

Gait Posture. 2018 Jul 3. pii: S0966-6362(18)30984-6. doi: 10.1016/j.gaitpost.2018.06.198. [Epub ahead of print]
[PMID: 30006096](#)

12. Duchenne gait in cerebral palsy: Is it a primary motor function deficit or a compensation?

Rethwilm R, Böhm H, Oestreich C, Federolf P.

Gait Posture. 2018 Jun 25. pii: S0966-6362(18)30893-2. doi: 10.1016/j.gaitpost.2018.06.136. [Epub ahead of print]
 PMID: 30007492

13. Benefits of hippotherapy in children with cerebral palsy: A narrative review.

Martín-Valero R, Vega-Ballón J, Perez-Cabezas V.

Eur J Paediatr Neurol. 2018 Jul 10. pii: S1090-3798(17)30174-5. doi: 10.1016/j.ejpn.2018.07.002. [Epub ahead of print]

Children with cerebral palsy display disorders in pelvic movement and require effective rehabilitation. There is evidence to support the hippotherapy due to improvements in balance. The aim of this narrative review was to summarise the grades of recommendation regarding the benefits of hippotherapy in children with cerebral palsy. DATA SOURCES AND EXTRACTION: We searched electronic databases, limiting the searches to studies published between 2004 and February 2017. The selected documents were classified according to the strength of recommendation provided by Duodecim (the Finnish medical society). The methodological quality of the selected studies was evaluated using the PEDro scale. RESULTS: 18 studies (four graded A, eight graded B and six graded C) showed clinical changes in the outcomes of gross motor function, sitting independently, speed of walking, length of stride and postural alignment of the head in children with cerebral palsy. Study quality was poor to good (mean PEDro Score of 6 out of 10).

Benefits were identified in relation to psychological factors, as well as positive effects on quality of life and the performance of daily life activities. **CONCLUSIONS:** Gains were also observed in postural alignment and the balance of head and trunk. Moreover, there were improvements in quality of life and the activities of daily life, such as jumping, balance, strength and ascending and descending stairs.

[PMID: 30017618](#)

14. Factors influencing gait analysis related decision-making of clinicians managing children and young people with cerebral palsy: A qualitative study.

Hebda-Boon A, Zhang B, Adu-Amankwah A, Shortland A, Morrissey D.

Gait Posture. 2018 Jun 19. pii: S0966-6362(18)30790-2. doi: 10.1016/j.gaitpost.2018.06.063. [Epub ahead of print]
PMID: 30007490

Prevention and Cure

15. Perinatal Anemia is Associated with Neonatal and Neurodevelopmental Outcomes in Infants with Moderate to Severe Perinatal Asphyxia.

Kalteren WS, Ter Horst HJ, den Heijer AE, de Vetten L, Kooi EMW, Bos AF.

Neonatology. 2018 Jul 19;114(4):315-322. doi: 10.1159/000490369. [Epub ahead of print]

Perinatal anemia may cause perinatal asphyxia. Its pathophysiology and neurodevelopmental effects are theoretically different from other causes of perinatal asphyxia. The study aimed to determine whether perinatal anemia results in different short-term and long-term outcomes than other causes of perinatal asphyxia treated with therapeutic hypothermia. We retrospectively included infants with moderate to severe hypoxic-ischemic encephalopathy, born between May 2009 and October 2015. During follow-up, we assessed cognitive and motor development at 2-3 years of age, using the Bayley Scales of Infant and Toddler Development, third edition (BSID-III). Neurodevelopmental outcome (NDO) was classified as abnormal in case of cerebral palsy with Gross Motor Function Classification System \geq III and/or a BSID-III composite score $<$ 85. Outcomes of infants with perinatal anemia (initial hemoglobin $<$ 7 mmol/L) were compared to infants born with perinatal asphyxia due to other causes. In total, 111 infants were included of whom 30 infants (27%) died during the neonatal period. Infants with anemia ($n = 23$) had a higher mortality risk, OR 3.33, 95% CI 1.27-8.72, $p = 0.01$. None of the surviving infants with anemia ($n = 12$) had an abnormal NDO, in contrast to 26/69 (38%) with neurodevelopmental impairments, particularly motor problems, in the non-anemic group, $p < 0.01$. Perinatal anemia causing moderate to severe perinatal asphyxia is associated with a higher risk for neonatal mortality. All survivors with perinatal anemia, however, showed a normal NDO in contrast to children who were born asphyxiated due to other causes. The underlying pathophysiological mechanism for the favorable NDO in the perinatal anemia group needs further elucidation.

[PMID: 30025408](#)

16. Putting prevention into practice for the benefit of children and young people with cerebral palsy.

Himmelmann K.

Arch Dis Child. 2018 Jul 18. pii: archdischild-2018-315134. doi: 10.1136/archdischild-2018-315134. [Epub ahead of print]
PMID: 30021786

17. Long-term outcomes after group B streptococcus infection: a cohort study.

Yeo KT, Lahra M, Bajuk B, Hilder L, Abdel-Latif ME, Wright IM, Oei JL.

Arch Dis Child. 2018 Jul 17. pii: archdischild-2017-314642. doi: 10.1136/archdischild-2017-314642. [Epub ahead of print]

To describe the risk of death and hospitalisation until adolescence of children after group B streptococcus (GBS) infection during infancy. Population-based cohort study. New South Wales, Australia. **PATIENTS:** All registered live births from 2000 to 2011. **INTERVENTIONS:** Comparison of long-term outcomes in children with the International Statistical Classification of Diseases and Related Health Problems-10th Revision discharge codes corresponding to GBS infections and those without. **MAIN OUTCOME MEASURES:** Death and hospitalisation. **RESULTS:** A total of 1206 (0.1%) children (936 (77.6%) \geq 37 weeks' gestation) were diagnosed with GBS infection.

Over the study period, infection rates decreased from 2.1 (95% CI 1.8 to 2.4) to 0.7 (95% CI 0.5 to 0.9) per 1000 live births. Infants with GBS infection were born at lower gestation (mean 37.6 vs 39.0 weeks), were more likely very low birth weight (<1500 g, OR 9.1(95% CI 7.4 to 11.3)), born premature (OR 3.9(95% CI 3.4 to 4.5)) and have 5 min Apgar scores ≤ 5 (OR 6.7 (95% CI 5.1 to 8.8)). Children with GBS had three times the adjusted odds of death (adjusted OR (AOR) 3.0(95% CI 2.1 to 4.3)) or rehospitalisations (AOR 3.1(95% CI 2.7 to 3.5)). Thirty-six (3.0%) with GBS died, with >50% of deaths occurring <28 days. Children with GBS were hospitalised more frequently (median 2 vs 1), for longer duration (mean 3.7 vs 2.2 days) and were at higher risk for problems with genitourinary (OR 3.1(95% CI 2.8 to 3.5)) and nervous (OR 2.0 (95% CI 1.7 to 2.3)) systems. CONCLUSIONS: Despite decreasing GBS rates, the risk of poor health outcomes for GBS-infected children remains elevated, especially during the first 5 years. Survivors continue to be at increased risk of death and chronic conditions requiring hospitalisations, such as cerebral palsy and epilepsy.

[PMID: 30018069](#)

18. Criteria to define mild, moderate, and severe traumatic brain injury in the mouse controlled cortical impact model.

Siebold L, Obenaus A, Goyal R.

Exp Neurol. 2018 Jul 12. pii: S0014-4886(18)30218-8. doi: 10.1016/j.expneurol.2018.07.004. [Epub ahead of print]

Traumatic brain injury (TBI) is a major health concern in the United States resulting in a substantial number of hospitalizations and in a broad spectrum of symptoms and disabilities. In the clinical setting, neurological responsiveness and structural imaging are used to classify mild, moderate and severe TBI. To evaluate the complex secondary and severity-specific injury response, investigators have relied on pre-clinical rodent models. The controlled cortical impact (CCI) model in mice is a widely used to study TBI. The CCI method has demonstrated consistent intra-laboratory outcomes due to precise control of cortical depth penetration, dwell time and speed of impact. While the CCI method results in control of injury severity, there is no consensus regarding the injury parameters or behavioral and histological endpoints that constitute a mild, moderate or severe TBI in this model. This discrepancy has resulted in considerable variability across laboratories in the outcomes of CCI-induced mild, moderate, and severe TBI. Inconsistent with clinical evaluation, injury severity in the CCI model has predominately relied on the extent of tissue damage. In the present review, we discuss variations in surgical parameters for injury induction as well as the criteria used to determine injury severity. Additionally, we propose guiding principles for the induction and defining of mild, moderate and severe TBI in the craniectomy-dependent experimental mouse CCI model.

[PMID: 30017882](#)

19. Cerebellar injury and impaired function in a rabbit model of maternal inflammation induced neonatal brain injury.

Zhang Z, Narayan S, Su L, Al-Alawy H, Liu J, Kannan S.

Neurobiol Learn Mem. 2018 Jul 14. pii: S1074-7427(18)30165-5. doi: 10.1016/j.nlm.2018.07.005. [Epub ahead of print]

Cerebellum is involved in higher cognitive functions and plays important roles in neurological disorders. Cerebellar injury has been detected frequently in patients with preterm birth resulting in cognitive dysfunction later in life. Maternal infection and inflammation is associated with preterm birth and in neonatal brain injury. We have previously shown that intrauterine lipopolysaccharide (LPS) exposure induces white matter injury and microglial activation in the cerebral white matter tracts of neonatal rabbits, resulting in motor deficits consistent with the clinical findings of cerebral palsy (CP). Here we investigated whether intrauterine LPS exposure induced cerebellar inflammation and functional impairment. Timed-pregnant New Zealand white rabbits underwent a laparotomy on gestational day 28 (G28) and LPS (3200 EU, endotoxin group) was injected along the wall of the uterus as previously described. Controls did not receive surgical intervention. Kits born to control and endotoxin treated dams were euthanized on postnatal day (PND)1 (3 days post-injury) or PND5 (7 days post-injury) and cerebellum evaluated for presence of inflammation. The microglial morphology in cerebellar white matter areas was analyzed using Neurolucida and Neurolucida Explorer. mRNA expression of inflammatory cytokines was quantified by real-time-PCR. We found that intrauterine exposure to LPS induced intensive microglial activation in cerebellar white matter areas, as evidenced by increased numbers of activated microglia and morphological changes (amoeboid soma and retracted processes) that was accompanied by significant increases in pro-inflammatory cytokines. The Purkinje cell layer was less developed in endotoxin exposed kits than healthy controls. In kits that survived to PND 60, soma size and cell density of Purkinje cells were significantly decreased in endotoxin exposed kits compared to controls. The findings of altered Purkinje cell morphology were consistent with impaired cerebellar function as tested by eye-blink conditioning at 1 month of age. The results indicate that the cerebellum is vulnerable to perinatal insults and that therapies targeting cerebellar inflammation and injury may help in improving outcomes and

[PMID: 30016703](#)

20. Comparison of children diagnosed with cerebral palsy in a private cord blood bank to an epidemiological sample.

Mazonson P, Kane M, Colberg K, Harris H, Brown H, Mohr A, Santas C, Sandler A.

Res Dev Disabil. 2018 Jul 12;80:153-160. doi: 10.1016/j.ridd.2018.06.011. [Epub ahead of print]

Although cord blood (CB) stem cell research is being conducted for treatment of cerebral palsy (CP), little is known about children with CP and stored CB. To compare demographic and clinical characteristics of children with CP and stored CB to children with CP identified in a population-based study. The Longitudinal Umbilical Stem cell monitoring and Treatment REsearch (LUSTRE®) Registry recruited children from the largest US private CB bank. Demographics, co-morbidities, and gross motor function (GMFCS level and walking ability) were collected and, where possible, compared with the CDC's Autism and Developmental Disabilities Monitoring (ADDM) Network. 114 LUSTRE participants were compared to 451 ADDM participants. LUSTRE participants were more likely to be white, but sex distribution was similar. Co-morbidities (autism and epilepsy) and functional mobility were also similar. The results of this analysis suggest that while children diagnosed with CP and with access to stored CB differ from a broader population sample in terms of demographics, they have similar clinical severity and comorbidity profiles. As such, LUSTRE may serve as a valuable source of data for the characterization of individuals with CP, including individuals who have or will receive CB infusions.

[PMID: 30015273](#)

21. Brain lesion scores obtained using a simple semi-quantitative scale from MR imaging are associated with motor function, communication and cognition in dyskinetic cerebral palsy.

Laporta-Hoyos O, Fiori S, Pannek K, Ballester-Plané J, Leiva D, Reid LB, Pagnozzi AM, Vázquez É, Delgado I, Macaya A, Pueyo R, Boyd RN.

Neuroimage Clin. 2018 Jun 14;19:892-900. doi: 10.1016/j.nicl.2018.06.015. eCollection 2018.

To characterise brain lesions in dyskinetic cerebral palsy (DCP) using the semi-quantitative scale for structural MRI (sqMRI) and to investigate their relationship with motor, communication and cognitive function. Thirty-nine participants (19 females, median age 21y) with DCP were assessed in terms of motor function, communication and a variety of cognitive domains. Whole-head magnetic resonance imaging (MRI) was performed including T1-MPRAGE, T2 turbo spin echo (axial plane), and fluid attenuated inversion recovery images (FLAIR). A child neurologist visually assessed images for brain lesions and scored these using the sqMRI. Ordinal, Poisson and binomial negative regression models identified which brain lesions accounted for clinical outcomes. Brain lesions were most frequently located in the ventral posterior lateral thalamus and the frontal lobe. Gross ($B = 0.180$, $p < .001$; $B = 0.658$, $p < .001$) and fine ($B = 0.136$, $p = .003$; $B = 0.540$, $p < .001$) motor function were associated with global sqMRI score and parietal involvement. Communication functioning was associated with putamen involvement ($B = 0.747$, $p < .028$). Intellectual functioning was associated with global sqMRI score and posterior thalamus involvement ($B = -0.018$, $p < .001$; $B = -0.192$, $p < .001$). Selective attention was associated with global sqMRI score ($B = -0.035$, $p < .001$), parietal ($B = -0.063$, $p = .023$), and corpus callosum involvement ($B = -0.448$, $p < .001$). Visuospatial and visuo-perceptive abilities were associated with global sqMRI score ($B = -0.078$, $p = .007$) and medial dorsal thalamus involvement ($B = -0.139$, $p < .012$), respectively. Key clinical outcomes in DCP are associated with specific observable brain lesions as indexed by a simple lesion scoring system that relies only on standard clinical MRI.

[PMID: 30013928](#)

22. Maternal concentrations of human chorionic gonadotropin (hCG) and risk for cerebral palsy (CP) in the child. A case control study.

Eskild A, Monkerud L, Jukic AM, Åsvold BO, Lie KK.

Eur J Obstet Gynecol Reprod Biol. 2018 Jul 4;228:203-208. doi: 10.1016/j.ejogrb.2018.07.003. [Epub ahead of print]

Intrauterine conditions may be important in the development of cerebral palsy in the child. The hormone, human chorionic gonadotropin (hCG), is synthesized in the placenta, and hCG plays an important role in placental angiogenesis and development. Thus, maternal hCG concentrations may be an indicator of placental function and thereby the intrauterine environment for the offspring. We studied the associations of maternal concentrations of hCG during pregnancy with cerebral palsy in the child. We performed a case-control study nested within a cohort of 29,948 pregnancies in Norway during 1992-1994. Cases were all women within the cohort who gave birth to a singleton child with cerebral palsy diagnosed before five years of age ($n = 63$). Controls were a random sample of women with a singleton child without cerebral palsy ($n = 182$). The adjusted odds ratio (OR) for cerebral palsy in the child was 0.78 (95% CI: 0.55-1.10) per log-transformed unit of maternal hCG in the 1st trimester, and the OR was 1.42 (95% CI: 0.94-2.16) in the 2nd trimester. Thus, women who did not have high hCG concentrations in the 1st trimester and low hCG concentrations in the 2nd trimester, had increased risk for giving birth to a child with cerebral palsy. Adjustments were made for pregnancy week of serum sampling, maternal age and parity. The abnormal hCG concentrations in pregnancies with cerebral palsy in the offspring, could suggest placental factors as causes of cerebral palsy.

[PMID: 30007247](#)

23. The Impact of Systemic Inflammation on Neurodevelopment.

Jiang NM, Cowan M, Moonah SN, Petri WA Jr.

Trends Mol Med. 2018 Jul 10. pii: S1471-4914(18)30135-7. doi: 10.1016/j.molmed.2018.06.008. [Epub ahead of print]

Inflammatory mediators affect the brain during development. Neurodevelopmental disorders such as autism spectrum disorders, cognitive impairment, cerebral palsy, epilepsy, and schizophrenia have been linked to early life inflammation. Recent advances have shown the effects of systemic inflammation on children's neurodevelopment. We discuss the potential mechanisms by which inflammatory molecules can exert their effects on the developing brain and consider the roles of MHC class I molecules, the HPA axis, glial cells, and monoamine metabolism. Methods to prevent the effects of cytokine imbalance may lead to the development of new therapeutics for neuropsychiatric disorders. Future research should focus on identifying at-risk individuals and early effective interventions to prevent long-term neurodevelopmental disabilities.

[PMID: 30006148](#)

24. Trends in the prevalence and characteristics of unilateral spastic cerebral palsy in patients born between 1988 and 2007 in Okinawa, Japan. [Article in Japanese]

Touyama M, Touyama J, Kinjo Y.

No To Hattatsu. 2017 Jan;49(1):11-4.

The objective of this study was to investigate the trends in the prevalence and characteristics of unilateral spastic cerebral palsy among children born between 1988 and 2007 in Okinawa, Japan. We conducted a surveillance of children with cerebral palsy using the local cerebral palsy registration system. For analysis purposes, the study was divided into two periods: period I (from 1988 to 1997) and period II (from 1998 to 2007). We performed a chi-squared test and Poisson regression analysis. We observed a significant trend for an increased prevalence of unilateral spastic cerebral palsy in period II ($p < 0.01$). The number of children with unilateral spastic cerebral palsy who were born with birth weights of 1500 g or more and/or a gestational age of 32 weeks or more was increased in period II. In addition, brain magnetic resonance imaging and computed tomography scans showed that porencephaly and periventricular white matter damage were common findings in preterm children of gestational age less than 31 weeks in period II. The most frequently observed neuroimaging feature in children with a gestational age of over 32 weeks was brain infarction. We found a trend for an increased prevalence of unilateral spastic cerebral palsy in period II. However, the cause of this increase is as yet unknown.

[PMID: 30011147](#)