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Interventions and Management

1. Kinematic characteristics of reaching in children with hemiplegic cerebral palsy: A comparative study.

Aboelnasr EA, Hegazy FA, Altalway HA.

Brain Inj. 2016 Nov 10:1-7. [Epub ahead of print]

BACKGROUND: Practitioners need more sensitive measures to quantify reaching movement for judgement of the treatment effects and reflecting the degrees of motor impairment in upper extremities. **OBJECTIVE:** The purposes of this study were to differentiate between spastic and normal reaching using three-dimensional (3D) motion analysis and to quantify the interference of spasticity on reaching movement in children with congenital hemiplegic cerebral palsy. **METHODS:** Fifteen children with hemiplegic CP as a study group and 15 normal typically-developing (TD) children as a control group were studied. Participants were asked to reach forward, at a self-selected pace, toward one target at a normalized distance. A motion analysis system was used to record the trajectory of reaching performance. Kinematic parameters were computed and analysed. **RESULTS:** There were significant differences between the normal and spastic reaching ($p < 0.001$). Hemiplegic CP demonstrated slower and less smooth (higher normalized jerk score and more movement units) movement than the TD group, this reflects feedback guidance to correct spatial inaccuracy of reaching in hemiplegic CP. **CONCLUSION:** Kinematic analysis quantifies reaching characteristics and provides objective information about the motor strategies associated with goal-oriented tasks.

[PMID: 27830945](#)

2. The Salford Gait Tool: Does the clinical experience of the raters influence the inter-rater reliability?

Paci M, Mini G, Marchettini M, Ferrarello F.

Dev Neurorehabil. 2016 Nov 7:1-2. [Epub ahead of print]

PURPOSE: The purpose of this study was to verify if the amount of experience or the specific professional field of the raters may influence inter-rater reliability of the Salford Gait Tool (SF-GT). **METHODS:** Standardized videos of gait of seven children with cerebral palsy were recorded and assessed by three physiotherapists with experience in pediatrics (PPTs), three physiotherapists with experience with adult individuals (n-PPTs), and three students of physiotherapy. **RESULTS:** The inter-rater reliability both for joints and gait events was acceptable ($ICC \geq .70$) for PPTs and n-PPTs, but not for students. **CONCLUSIONS:** The inter-rater reliability of the SF-GT can be influenced by the experience of the raters and the amount of clinical experience seems to be more relevant than the specific professional field. Further research should be conducted with larger samples.

[PMID: 27820658](#)

3. Immature Spinal Locomotor Output in Children with Cerebral Palsy.

Cappellini G, Ivanenko YP, Martino G, MacLellan MJ, Sacco A, Morelli D, Lacquaniti F.

Front Physiol. 2016 Oct 25;7:478. eCollection 2016.

Detailed descriptions of gait impairments have been reported in cerebral palsy (CP), but it is still unclear how maturation of the spinal motoneuron output is affected. Spatiotemporal alpha-motoneuron activation during walking can be assessed by mapping the electromyographic activity profiles from several, simultaneously recorded muscles onto the anatomical rostrocaudal location of the motoneuron pools in the spinal cord, and by means of factor analysis of the muscle activity profiles. Here, we analyzed gait kinematics and EMG activity of 11 pairs of bilateral muscles with lumbosacral innervation in 35 children with CP (19 diplegic, 16 hemiplegic, 2-12 years) and 33 typically developing (TD) children (1-12 years). TD children showed a progressive reduction of EMG burst durations and a gradual reorganization of the spatiotemporal motoneuron output with increasing age. By contrast, children with CP showed very limited age-related changes of EMG durations and motoneuron output, as well as of limb intersegmental coordination and foot trajectory control (on both sides for diplegic children and the affected side for hemiplegic children). Factorization of the EMG signals revealed a comparable structure of the motor output in children with CP and TD children, but significantly wider temporal activation patterns in children with CP, resembling the patterns of much younger TD infants. A similar picture emerged when considering the spatiotemporal maps of alpha-motoneuron activation. Overall, the results are consistent with the idea that early injuries to developing motor regions of the brain substantially affect the maturation of the spinal locomotor output and consequently the future locomotor behavior.

[PMID: 27826251](#)

4. Total hip replacement in young non-ambulatory cerebral palsy patients.

Morin C, Ursu C, Delecourt C.

Orthop Traumatol Surg Res. 2016 Nov;102(7):845-849. doi: 10.1016/j.otsr.2016.07.010. Epub 2016 Sep 30.

INTRODUCTION: The everyday life of a non-ambulatory adolescent or young adult with cerebral palsy can be severely impaired by a painful or stiff hip. The usual surgical solutions such as proximal femoral resection (PFR) are not entirely satisfactory for pain relief, and are mutilating. **HYPOTHESIS:** A retrospective study assessed the impact of total hip replacement (THR) on such impairment, on the hypothesis that it is more effective than PFR in relieving pain, without aggravating disability. **PATIENTS AND METHODS:** The surgical technique consisted in implanting a dual-mobility prosthesis with uncemented acetabular component and cemented femur, after upper femoral shaft shortening and short hip-spica cast immobilization. Forty THRs were performed in 33 patients, including 31 with multiple disability. Follow-up assessment focused on change in functional status, pain, and range of motion. **RESULTS:** Mean follow-up was 5 years. Pain was more or less entirely resolved. Improvement in range of motion was less striking, and there was no significant change in functional status. There were 2 general, 2 septic and 10 mechanical complications, 6 of which required surgical revision. **DISCUSSION:** In non-ambulatory cerebral palsy, THR provided much better alleviation of pain than found with PFR treatment. It should be reserved for patients able to withstand fairly long surgery and with femur size compatible with implantation of a femoral component, however small.

[PMID: 27697405](#)

5. Cortical bone deficit and fat infiltration of bone marrow and skeletal muscle in ambulatory children with mild spastic cerebral palsy.

Whitney DG, Singh H, Miller F, Barbe MF, Slade JM, Pohlig RT, Modlesky CM.

Bone. 2016 Oct 11;94:90-97. doi: 10.1016/j.bone.2016.10.005. [Epub ahead of print]

INTRODUCTION: Nonambulatory children with severe cerebral palsy (CP) have underdeveloped bone architecture, low bone strength and a high degree of fat infiltration in the lower extremity musculature. The present study aims to determine if such a profile exists in ambulatory children with mild CP and if excess fat infiltration extends into the bone marrow. **MATERIALS AND METHODS:** Ambulatory children with mild spastic CP and typically developing children (4 to 11 years; 12/group) were compared. Magnetic resonance imaging was used to estimate cortical bone, bone marrow and total bone volume and width,

bone strength [i.e., section modulus (Z) and polar moment of inertia (J)], and bone marrow fat concentration in the midtibia, and muscle volume, intermuscular, subfascial, and subcutaneous adipose tissue (AT) volume and intramuscular fat concentration in the midleg. Accelerometer-based activity monitors worn on the ankle were used to assess physical activity. RESULTS: There were no group differences in age, height, body mass, body mass percentile, BMI, BMI percentile or tibia length, but children with CP had lower height percentile (19th vs. 50th percentile) and total physical activity counts (44%) than controls (both $p < 0.05$). Children with CP also had lower cortical bone volume (30%), cortical bone width in the posterior (16%) and medial (32%) portions of the shaft, total bone width in the medial-lateral direction (15%), Z in the medial-lateral direction (34%), J (39%) and muscle volume (39%), and higher bone marrow fat concentration ($82.1 \pm 1.8\%$ vs. $80.5 \pm 1.9\%$), subfascial AT volume (3.3 fold) and intramuscular fat concentration ($25.0 \pm 8.0\%$ vs. $16.1 \pm 3.3\%$) than controls (all $p < 0.05$). When tibia length was statistically controlled, all group differences in bone architecture, bone strength, muscle volume and fat infiltration estimates, except posterior cortical bone width, were still present (all $p < 0.05$). Furthermore, a higher intermuscular AT volume in children with CP compared to controls emerged ($p < 0.05$). CONCLUSIONS: Ambulatory children with mild spastic CP exhibit an underdeveloped bone architecture and low bone strength in the midtibia and a greater infiltration of fat in the bone marrow and surrounding musculature compared to typically developing children. Whether the deficit in the musculoskeletal system of children with CP is associated with higher chronic disease risk and whether the deficit can be mitigated requires further investigation.

[PMID: 27732905](#)

6. The Danish Cerebral Palsy Follow-up Program.

Rasmussen HM, Nordbye-Nielsen K, Møller-Madsen B, Johansen M, Ellitsgaard N, Pedersen CR, Rackauskaite G, Engberg H, Pedersen NW.

Clin Epidemiol. 2016 Oct 25;8:457-460. eCollection 2016.

AIM OF DATABASE: The Danish Cerebral Palsy Follow-up Program is a combined follow-up program and national clinical quality database that aims to monitor and improve the quality of health care for children with cerebral palsy (CP). STUDY POPULATION: The database includes children with CP aged 0-15 years and children with symptoms of CP aged 0-5 years. MAIN VARIABLES: In the follow-up program, the children are offered examinations throughout their childhood by orthopedic surgeons, physiotherapists, occupational therapists, and pediatricians. Examinations of gross and fine motor function, manual ability, muscle tone, passive range of motion, use of orthotics, and assistive devices are performed once a year; radiographic examination of the hips is planned based on the child's age and gross motor function; and the diagnosis is performed once before the age of 5 years. Six indicators were developed based on scientific literature and consensus in the steering committee, and their calculation is based on the following four main variables: radiographic examination of the hip, gross motor function, manual ability, and diagnosis. DESCRIPTIVE DATA: The 2014 annual report includes results of the quality indicators in three of five regions in Denmark comprising 432 children with CP, corresponding to a coverage of 82% of the expected population. CONCLUSION: The Danish Cerebral Palsy Follow-up Program is currently under development as a national clinical quality database in Denmark. The database holds potential for research in prevalence, clinical characteristics of the population, and the effects of prevention and treatment.

[PMID: 27822084](#)

7. Radial shock wave therapy: effect on pain and motor performance in a paralympic athlete. A case report.

Mori L, Marinelli L, Pelosin E, Gambaro M, Trentini R, Abbruzzese G, Trompetto C.

Eur J Phys Rehabil Med. 2016 Nov 8. [Epub ahead of print]

BACKGROUND: Recent studies demonstrated the usefulness of Radial Shock Waves Therapy (RSWT) in treating hypertonia in patients affected by cerebral palsy (CP), stroke, and dystonia. RSWT have never been used to treat spasticity in disabled athletes. CASE REPORT: An athlete affected by tetraparesis due to CP underwent three RSWT sessions in a week. We assessed muscular tone using the Modified Ashworth scale (MAS), pain and fatigue experienced during athletic performance with Visual Analogic Scale (VAS) and Borg scale Category-Ratio anchored at number 10 (Borg CR10). We also performed an electrophysiological study recording the stretch reflex on the quadriceps femori muscle and assessing the soleus H-reflex to calculate post-activation depression (PAD). After 3 RSWT sessions, we found a reduction in all clinical parameters. Although MAS was unchanged, stretch reflex was significantly reduced and PAD increased, suggesting a role in contrasting non-reflex components of hypertonia.

[PMID: 27824235](#)

8. Application of a tri-axial accelerometry-based portable motion recorder for the quantitative assessment of hippotherapy in children and adolescents with cerebral palsy.

Mutoh T, Mutoh T, Takada M, Doumura M, Ihara M, Taki Y, Tsubone H, Ihara M.

J Phys Ther Sci. 2016 Oct;28(10):2970-2974. Epub 2016 Oct 28.

[Purpose] This case series aims to evaluate the effects of hippotherapy on gait and balance ability of children and adolescents with cerebral palsy using quantitative parameters for physical activity. [Subjects and Methods] Three patients with gait disability as a sequela of cerebral palsy (one female and two males; age 5, 12, and 25 years old) were recruited. Participants received hippotherapy for 30 min once a week for 2 years. Gait parameters (step rate, step length, gait speed, mean acceleration, and horizontal/vertical displacement ratio) were measured using a portable motion recorder equipped with a tri-axial accelerometer attached to the waist before and after a 10-m walking test. [Results] There was a significant increase in step length between before and after a single hippotherapy session. Over the course of 2 year intervention, there was a significant increase in step rate, gait speed, step length, and mean acceleration and a significant improvement in horizontal/vertical displacement ratio. [Conclusion] The data suggest that quantitative parameters derived from a portable motion recorder can track both immediate and long-term changes in the walking ability of children and adolescents with cerebral palsy undergoing hippotherapy.

[PMID: 27821971](#)

9. Dance Improves Functionality and Psychosocial Adjustment in Cerebral Palsy: A Randomized Controlled Clinical Trial.

Teixeira-Machado L, Azevedo-Santos I, DeSantana JM.

Am J Phys Med Rehabil. 2016 Nov 4. [Epub ahead of print]

OBJECTIVE: This randomized controlled clinical trial aimed to investigate the effect of dance in the functionality and psychosocial adjustment of young subjects with cerebral palsy (CP). **DESIGN AND METHODS:** Twenty-six young subjects with CP, GMFCS (Gross Motor Function Classification System) levels from II to V, were randomized into two intervention groups: kinesiotherapy and dance (n = 13 each). Twenty-four sessions (1 hour, twice a week) were performed in both groups. Functional Independence Measure (FIM) and World Health Organization Disability Assessment Schedule (WHODAS) by International Classification of Functioning, Disability and Health (ICF) were used before and after each intervention. **RESULTS:** Dance increased the classification of functioning (P = 0.001), independence function (P = 0.004), self-care (P = 0.01), mobility (P = 0.008), locomotion (P = 0.01), communication (P = 0.02), psychosocial adjustments (P = 0.04), and cognitive function (P = 0.03). Intergroup analysis evidenced significantly greater improvements in classification of functioning (P = 0.0002), independence function (P = 0.0006), self-care (P = 0.01), mobility (P = 0.001), locomotion (P = 0.002), communication (P = 0.0001), psychosocial adjustments (P = 0.002), and cognitive function (P = 0.0001) in dance group. **CONCLUSIONS:** It was shown that this approach could have an influence on basic common points in the body and motion, including emotional and social aspects, supporting the concept of complex multimodal psychomotor adjustments. Dance promoted enhancement on functionality and social activities regarding psychosocial adjustments in cerebral palsy young subjects.

[PMID: 27820729](#)

10. The use of commercial video games in rehabilitation: a systematic review.

Bonnechère B, Jansen B, Omelina L, Van Sint Jan S.

Int J Rehabil Res. 2016 Dec;39(4):277-290.

The aim of this paper was to investigate the effect of commercial video games (VGs) in physical rehabilitation of motor functions. Several databases were screened (Medline, SAGE Journals Online, and ScienceDirect) using combinations of the following free-text terms: commercial games, video games, exergames, serious gaming, rehabilitation games, PlayStation, Nintendo, Wii, Wii Fit, Xbox, and Kinect. The search was limited to peer-reviewed English journals. The beginning of the search time frame was not restricted and the end of the search time frame was 31 December 2015. Only randomized controlled trial, cohort, and observational studies evaluating the effect of VGs on physical rehabilitation were included in the review. A

total of 4728 abstracts were screened, 275 were fully reviewed, and 126 papers were eventually included. The following information was extracted from the selected studies: device type, number and type of patients, intervention, and main outcomes. The integration of VGs into physical rehabilitation has been tested for various pathological conditions, including stroke, cerebral palsy, Parkinson's disease, balance training, weight loss, and aging. There was large variability in the protocols used (e.g. number of sessions, intervention duration, outcome measures, and sample size). The results of this review show that in most cases, the introduction of VG training in physical rehabilitation offered similar results as conventional therapy. Therefore, VGs could be added as an adjunct treatment in rehabilitation for various pathologies to stimulate patient motivation. VGs could also be used at home to maintain rehabilitation benefits.

[PMID: 27508968](#)

11. Effects of Nintendo Wii-Fit® video games on balance in children with mild cerebral palsy.

Tarakci D, Ersoz Huseyinsinoglu B, Tarakci E, Razak Ozdincler A.

Pediatr Int. 2016 Oct;58(10):1042-1050. doi: 10.1111/ped.12942. Epub 2016 Aug 23.

BACKGROUND: This study compared the effects of Nintendo Wii-Fit® balance-based video games and conventional balance training in children with mild cerebral palsy (CP). **METHODS:** This randomized controlled trial involved 30 ambulatory pediatric patients (aged 5-18 years) with CP. Participants were randomized to either conventional balance training (control group) or to Wii-Fit balance-based video games training (Wii group). Both group received neuro-developmental treatment (NDT) during 24 sessions. In addition, while the control group received conventional balance training in each session, the Wii group played Nintendo Wii Fit games such as ski slalom, tightrope walk and soccer heading on balance board. Primary outcomes were Functional Reach Test (forward and sideways), Sit-to-Stand Test and Timed Get up and Go Test. Nintendo Wii Fit balance, age and game scores, 10 m walk test, 10-step climbing test and Wee-Functional Independence Measure (Wee FIM) were secondary outcomes. **RESULTS:** After the treatment, changes in balance scores and independence level in activities of daily living were significant ($P < 0.05$) in both groups. Statistically significant improvements were found in the Wii-based game group compared with the control group in all balance tests and total Wee FIM score ($P < 0.05$). **CONCLUSION:** Wii-fit balance-based video games are better at improving both static and performance-related balance parameters when combined with NDT treatment in children with mild CP.

[PMID: 26858013](#)

12. Stable cognitive functioning with improved perceptual reasoning in children with dyskinetic cerebral palsy and other secondary dystonias after deep brain stimulation.

Owen T, Adegboye D, Gimeno H, Selway R, Lin JP.

Eur J Paediatr Neurol. 2016 Oct 21. pii: S1090-3798(16)30186-6. doi: 10.1016/j.ejpn.2016.10.003. [Epub ahead of print]

BACKGROUND: Dystonia is characterised by involuntary movements (twisting, writhing and jerking) and postures. Secondary dystonias are described as a heterogeneous group of disorders with both exogenous and endogenous causes. There is a growing body of literature on the effects of deep brain stimulation (DBS) surgery on the motor function in childhood secondary dystonias, however research on cognitive function after DBS is scarce. **METHODS:** Cognitive function was measured in a cohort of 40 children with secondary dystonia following DBS surgery using a retrospective repeated measures design. Baseline pre-DBS neuropsychological measures were compared to scores obtained at least one year following DBS. Cognitive function was assessed using standardised measures of intellectual ability and memory. **RESULTS:** There was no significant change in the assessed domains of cognitive function following DBS surgery. A significant improvement across the group was found on the Picture Completion subtest, measuring perceptual reasoning ability, following DBS. **CONCLUSION:** Cognition remained stable in children with secondary dystonia following DBS surgery, with some improvements noted in a domain of perceptual reasoning. Further research with a larger sample is necessary to further explore this, in particular to further subdivide this group to account for its heterogeneity. This preliminary data has potentially positive implications for the impact of DBS on cognitive functioning within the childhood secondary dystonia population.

[PMID: 27836441](#)

13. Forward Prediction in the Posterior Parietal Cortex and Dynamic Brain-Machine Interface.

Cui H.

Front Integr Neurosci. 2016 Oct 26;10:35. eCollection 2016.

While remarkable progress has been made in brain-machine interfaces (BMIs) over the past two decades, it is still difficult to utilize neural signals to drive artificial actuators to produce predictive movements in response to dynamic stimuli. In contrast to naturalistic limb movements largely based on forward planning, brain-controlled neuroprosthetics mainly rely on feedback without prior trajectory formation. As an important sensorimotor interface integrating multisensory inputs and efference copy, the posterior parietal cortex (PPC) might play a proactive role in predictive motor control. Here it is proposed that predictive neural activity in PPC could be decoded to provide prosthetic control signals for guiding BMI systems in dynamic environments.

[PMID: 27833537](#)

14. Ocular findings in patients with spastic type cerebral palsy.

Park MJ, Yoo YJ, Chung CY, Hwang JM.

BMC Ophthalmol. 2016 Nov 8;16(1):195.

BACKGROUND: Refractive errors, strabismus, nystagmus, amblyopia, and cortical visual impairment are observed in 50 to 90 % of patients with cerebral palsy. Ocular abnormalities are known to differ according to cerebral palsy type, and spastic type has been reported to be more likely to be associated with ocular defects than the athetoid and ataxic types. **METHODS:** A retrospective review of medical records was performed on 105 consecutive children with spastic type of cerebral palsy who underwent ophthalmologic examination between July 2003 and March 2006. The complete ophthalmological examination included measurement of visual acuity, ocular motility, stereoacuity, binocular vision, cycloplegic refraction along with the evaluation of the anterior segment and the posterior segment. **RESULTS:** The most common ocular abnormality was strabismus (70.5 %) followed by refractive errors (53.3 %). Exodeviation was more commonly found than esodeviation (46 vs 27 patients), and hyperopia was much more prevalent than myopia. A considerable number of patients with strabismus had abnormal ocular motility wherein 16 patients showed inferior oblique overaction and ten superior oblique overaction. Whereas inferior oblique overaction was accompanied similarly in exotropia and esotropia, superior oblique overaction was accompanied more by exotropia. **CONCLUSIONS:** Children with spastic type cerebral palsy have a high prevalence of strabismus and refractive errors. Exotropia and hyperopia are the most common ocular abnormalities. All children with spastic type of cerebral palsy may require a detailed ophthalmologic evaluation.

[PMID: 27821110](#)

15. Prevalence of people who could benefit from augmentative and alternative communication (AAC) in the UK: determining the need.

Creer S, Enderby P, Judge S, John A.

Int J Lang Commun Disord. 2016 Nov;51(6):639-653. doi: 10.1111/1460-6984.12235. Epub 2016 Apr 26.

BACKGROUND: Commissioners and providers require information relating to the number of people requiring a service in order to ensure provision is appropriate and equitable for the population they serve. There is little epidemiological evidence available regarding the prevalence of people who could benefit from augmentative and alternative communication (AAC) in the UK. **AIM:** To determine the prevalence of people who could benefit from AAC in the UK. **METHODS & PROCEDURES:** An epidemiological approach was taken to create a new estimate of need: the prevalence of the main medical conditions and specific symptoms leading to the requirement for AAC were identified from the literature and AAC specialists were consulted to estimate the number of people who may require AAC. **OUTCOMES & RESULTS:** A total of 97.8% of the total number of people who could benefit from AAC have nine medical conditions: dementia, Parkinson's disease, autism, learning disability, stroke, cerebral palsy, head injury, multiple sclerosis and motor neurone disease. The total expectation is that 536 people per

100 000 of the UK population (approximately 0.5%) could benefit from AAC. **CONCLUSIONS & IMPLICATIONS:** To provide accurate figures on the potential need for and use of AAC, data need to be consistently and accurately recorded and regularly reviewed at a community level. The existing data suggest an urgent need for more accurate and up to date information to be captured about the need for AAC in the UK to provide better services and ensure access to AAC strategies, equipment and support.

[PMID: 27113569](#)

Prevention and Cure

16. Congenital Cytomegalovirus among Children with Cerebral Palsy.

Smithers-Sheedy H, Raynes-Greenow C, Badawi N, Fernandez MA, Kesson A, McIntyre S, Leung KC, Jones CA.

J Pediatr. 2016 Nov 3. pii: S0022-3476(16)31092-7. doi: 10.1016/j.jpeds.2016.10.024. [Epub ahead of print]

OBJECTIVES: To determine the proportion of children with cerebral palsy (CP) and cytomegalovirus (CMV) DNA detected retrospectively in their newborn screening cards (NBSC), to compare the proportion of children with CMV DNA in their NBSC across spastic subtypes of CP, and to compare the sex and other characteristics of children with CP and CMV detected on their NBSC with those in whom CMV DNA was not detected. **STUDY DESIGN:** Retrospective observational study. Data were extracted from patient records on children with CP (birth years 1996-2014) from 2 Australian state CP registers and state-wide paediatric rehabilitation services with consent. NBSCs were retrospectively analyzed for CMV DNA by nested polymerase chain reaction (PCR) using primers against gB. Positive samples were validated using real time PCR for CMV UL83. **RESULTS:** Of 401 children recruited, 323 (80.5%) had an available NBSC. Of these, 31 (9.6%; 95% CI, 6.8-13.3) tested positive for CMV DNA by nested PCR for CMV gB, of whom 28 (8.7%; 95% CI, 6.1-12.2) also had CMV DNA detected by real-time PCR for CMV UL83. Detection of CMV DNA was significantly associated with epilepsy, but not with clinical or epidemiologic characteristics, including sex and pattern of spasticity. **CONCLUSIONS:** CMV viremia in the newborn period, indicating congenital CMV infection, is highly prevalent among children with CP. Further research is needed to investigate the mechanisms and contribution of congenital CMV to the causal pathways to CP.

[PMID: 27816221](#)

17. Pathogenesis of cerebral palsy through the prism of immune regulation of nervous tissue homeostasis: literature review.

Lisovska N, Daribayev Z, Lisovskyy Y, Kussainova K, Austin L, Bulekbayeva S.

Childs Nerv Syst. 2016 Nov;32(11):2111-2117. Epub 2016 Sep 14.

BACKGROUND: The cerebral palsy is highly actual issue of pediatrics, causing significant neurological disability. Though the great progress in the neuroscience has been recently achieved, the pathogenesis of cerebral palsy is still poorly understood. **METHODS:** In this work, we reviewed available experimental and clinical data concerning the role of immune cells in pathogenesis of cerebral palsy. Maintaining of homeostasis in nervous tissue and its transformation in case of periventricular leukomalacia were analyzed. **RESULTS:** The reviewed data demonstrate involvement of immune regulatory cells in the formation of nervous tissue imbalance and chronicity of inborn brain damage. The supported opinion, that periventricular leukomalacia is not a static phenomenon, but developing process, encourages our optimism about the possibility of its correction. **CONCLUSIONS:** The further studies of changes of the nervous and immune systems in cerebral palsy are needed to create fundamentally new directions of the specific therapy and individual schemes of rehabilitation.

[PMID: 27638717](#)

18. Early Cord Metabolite Index and Outcome in Perinatal Asphyxia and Hypoxic-Ischaemic Encephalopathy.

Ahearne CE, Denihan NM, Walsh BH, Reinke SN, Kenny LC, Boylan GB, Broadhurst DI, Murray DM.

Neonatology. 2016;110(4):296-302. Epub 2016 Aug 3.

BACKGROUND: A ¹H-NMR-derived metabolomic index based on early umbilical cord blood alterations of succinate, glycerol, 3-hydroxybutyrate and O-phosphocholine has shown potential for the prediction of hypoxic-ischaemic encephalopathy (HIE) severity. **OBJECTIVE:** To evaluate whether this metabolite score can predict 3-year neurodevelopmental outcome in infants with perinatal asphyxia and HIE, compared with current standard biochemical and clinical markers. **METHODS:** From September 2009 to June 2011, infants at risk of perinatal asphyxia were recruited from a single maternity hospital. Cord blood was drawn and biobanked at delivery. Neonates were monitored for development of encephalopathy both clinically and electrographically. Neurodevelopmental outcome was assessed at 36-42 months using the Bayley Scales of Infant and Toddler Development, ed. III (BSID-III). Death and cerebral palsy were also considered as abnormal end points. **RESULTS:** Thirty-one infants had both metabolomic analysis and neurodevelopmental outcome at 36-42 months. No child had a severely abnormal BSID-III result. The metabolite index significantly correlated with outcome ($\rho^2 = 0.30$, $p < 0.01$), which is robust to predict both severe outcome (area under the receiver operating characteristic curve: 0.92, $p < 0.01$) and intact survival (0.80, $p = 0.01$). There was no correlation between the index score and performance in the individual BSID-III subscales (cognitive, language, motor). **CONCLUSIONS:** The metabolite index outperformed other standard biochemical markers at birth for prediction of outcome at 3 years, but was not superior to EEG or the Sarnat score.

[PMID: 27486995](#)