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Cerebral palsy research news

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Professor Nadia Badawi AM
Macquarie Group Foundation Chair of Cerebral Palsy

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Interventions and Management

1. Upper Extremity Rehabilitation Using Video Games in Cerebral Palsy: A Randomized Clinical Trial
Eren Avcil, Devrim Tarakci, Nilay Arman, Ela Tarakci

Acta Neurol Belg. 2020 Jun 11. doi: 10.1007/s13760-020-01400-8. Online ahead of print.

The aim of the present study was to compare the effects of neurodevelopmental therapy (NDT)-based upper extremity rehabilitation and video game-based therapy (VGBT) using Nintendo® wii and leap motion controller (LMC) games on upper extremity function in patients with cerebral palsy (CP). The 30 patients included in the present study were randomized to two groups: VGBT group (VGBT using Nintendo® Wii and LMC games) and control group (NDT-based upper extremity rehabilitation). Both groups trained 3 days a week for 8 weeks. Manual dexterity was evaluated using the "Minnesota Manual Dexterity Test (MMDT)", functional ability using the "Childhood Health Assessment Questionnaire (CHAQ)" and the "Duruoz Hand Index (DEI)" and grip and pinch strengths using a dynamometer. Following treatment, significant changes were found, MMDT, grip and pinch strength, CHAQ, and DHI scores in both groups ($p < 0.05$); however, VGBT group was statistically superior to group II with respect to changes in MMDT ($p < 0.05$). VGBT using Nintendo®Wii and LMC games had slightly superior effects on manual dexterity in patients with CP while compared with NDT-based upper extremity rehabilitation. Futhermore, the effects of both treatment programs on grip strengths and functional ability were similar beneficial.

PMID: 32524538

2. CORR Insights®: How Do Complications Within the First 30 Days After Spinal Deformity Surgery in Children With Cerebral Palsy Affect Length of Stay?
Kent A Reinker

Clin Orthop Relat Res. 2020 Jun 4. doi: 10.1097/CORR.0000000000001358. Online ahead of print.

PMID: 32511142

3. A Comparison of Hip Spica Casting to Short Leg Casts and Bar After Hip Reconstruction in Cerebral Palsy
Uyen Truong, Tonye Sylvanus, Trever M Koester, Chantel C Barney, Andrew G Georgiadis, Jennifer Carpenter, Walter Truong, Susan A Novotny

Cureus. 2020 May 8;12(5):e8028. doi: 10.7759/cureus.8028.

Background Immobilization after hip reconstruction in children with cerebral palsy varies according to surgeon preference. The effect of postoperative immobilization on postoperative pain is unknown. Success in achieving hip stability and complications may also differ depending on the immobilization technique utilized. Questions/purposes Using retrospective data, we aimed to evaluate: (a) what effect does postoperative immobilization with hip spica casting versus short leg casts and bar (SLCaB); have on pain and pain management in children with quadriplegic cerebral palsy undergoing femoral and/or pelvic osteotomy? and (b) Do complications and radiographic outcomes differ between those treated postoperatively with hip spica casting and those in short leg casts? Materials and Methods Children with quadriplegic cerebral palsy (GMFCS IV-V, mean age 7.8 years [range: 3-15 years]) undergoing femoral or pelvic osteotomy between 2012 and 2014 in the treatment of spastic hip subluxation were reviewed. Modes of immobilization were compared, between spica casting (n=15) and SLCaB (n=12). Preoperative, perioperative, and postoperative pain was quantified between groups. In-hospital epidural dosage, morphine equivalent dosages (MED), adjunctive medications, early maintenance of radiographic hip stability, and all complications were noted and analyzed. Results Children were more likely to have spica cast immobilization if they were younger. Postoperative pain scores were similar between groups, with comparable patterns of epidural and MED administered during hospitalization. Spica casts were often flared up during hospitalization, but skin ulcers were uncommon and comparable between the two groups. Within 12 months of surgery, more ipsilateral femur fractures were observed distant to implants in the hip spica group, although the incidence of fractures did not meet statistical thresholds. Conclusion Spica casting and SLCaB after neuromuscular hip reconstruction did not show a difference in hip stability, narcotic pain medication usage or complication profile.

PMID: 32528767

4. Minimum Clinically Important Difference of Gross Motor Function and Gait Endurance in Children With Motor Impairment: A Comparison of Distribution-Based Approaches
Fabio Alexander Storm, Maurizio Petrarca, Elena Beretta, Sandra Strazzer, Luigi Piccinini, Cristina Maghini, Daniele Panzeri, Claudio Corbetta, Roberta Morganti, Gianluigi Reni, Enrico Castelli, Flaminia Frascarelli, Alessandra Colazza, Giampietro Cordone, Emilia Biffi

Biomed Res Int. 2020 May 15;2020:2794036. doi: 10.1155/2020/2794036. eCollection 2020.

Objective: The minimum clinically important difference (MCID) is a standard way of measuring clinical relevance. The objective of this work was to establish the MCID for the 6-minute walking test (6minWT) and the Gross Motor Function Measure (GMFM-88) in pediatric gait disorders. Methods: A cohort, pretest-posttest study was conducted in a hospitalized care setting. A total of 182 patients with acquired brain injury (ABI) or cerebral palsy (CP) performed 20 robot-assisted gait training sessions complemented with 20 sessions of physical therapy over 4 weeks. Separate MCIDs were calculated using 5 distribution-based approaches, complemented with an anonymized survey completed by clinical professionals. Results: The MCID range for the 6minWT was 20-38 m in the ABI cohort, with subgroup ranges of 20-36 m for GMFCS I-II, 23-46 m for GMFCS III, and 24-46 m for GMFCS IV. MCIDs for the CP population were 6-23 m, with subgroup ranges of 4-28 m for GMFCS I-II, 9-19 m for GMFCS III, and 10-27 m for GMFCS IV. For GMFM-88 total score, MCID values were 1.1%-5.3% for the ABI cohort and 0.1%-3.0% for the CP population. For dimension "D" of the GMFM, MCID ranges were 2.3%-6.5% and 0.8%-5.2% for ABI and CP populations, respectively. For dimension "E," MCID ranges were 2.8%-6.5% and 0.3%-4.9% for ABI and CP cohorts, respectively. The survey showed a large interquartile range, but the results well mimicked the distribution-based methods. Conclusions: This study identified for the first time MCID ranges for 6minWT and GMFM-88 in pediatric patients with neurological impairments, offering useful insights for clinicians to evaluate the impact of treatments. Distribution-based methods should be used with caution: methods based on pre-post correlation may underestimate MCID when applied to patients with small improvements over the treatment period. Our results should be complemented with estimates obtained using consensus- and anchor-based approaches.

PMID: 32509855

5. Construct Validity of the Activities Scale for Kids Performance in Children With Cerebral Palsy: Brief Report
Stefania Costi, Daniela Mecugni, Laura Beccani, Silvia Alboresi, Barbara Bressi, Sara Paltrinieri, Adriano Ferrari, Elisa Pelosin

Dev Neurorehabil. 2020 Jun 7;1-4. doi: 10.1080/17518423.2020.1764649. Online ahead of print.

Aims: This study collects evidence of construct convergent validity of the Activity Scale for Kids performance (ASKp), comparing its results with the 66-item Gross Motor Function Measure (GMFM-66) and with the Gross Motor Function

Classification System (GMFCS) and testing the ASKp's ability to discriminate between individuals with different functional capabilities. Methods: This cross-sectional study involved 60 children with spastic cerebral palsy (CP) assessed with the GMFM-66 who self-administered the Italian version of the ASKp. Results: Children were 10.9 (±3) years old with GMFCS Level I-III. Moderate correlations were found between GMFM and ASKp scores ($r = 0.577$; $p < .001$), and between GMFCS levels and ASKp score ($rs = -0.541$, $p < .001$). The ASKp discriminated between children with different functional capabilities, determined by the GMFCS ($F = 18.2$, $p < .001$). Conclusions: ASKp is valid to assess physical functioning, a crucial domain in rehabilitation of children with spastic CP. Trial registration: ClinicalTrials.gov Identifier: NCT03325842.

PMID: 32508188

6. Biomechanics of Starting, Sprinting and Submaximal Running in Athletes With Brain Impairment: A Systematic Review
Brittany A Fiorese, Emma M Beckman, Mark J Connick, Adam B Hunter, Sean M Tweedy

Review J Sci Med Sport. 2020 May 18;S1440-2440(20)30015-3. doi: 10.1016/j.jsams.2020.05.006. Online ahead of print.

Objectives: Para athletes with brain impairment are affected by hypertonia, ataxia and athetosis, which adversely affect starting, sprinting and submaximal running. The aim was to identify and synthesise evidence from studies that have compared the biomechanics of runners with brain impairments (RBI) and non-disabled runners (NDR). Design: Systematic review. Methods: Five journal databases were systematically searched from inception to March 2020. Included studies compared the biomechanics of RBI (aged>14 years) and NDR performing either block-starts, sprinting, or submaximal running. Results: Eight studies were included, analysing a total of 100 RBI (78M:22F; 18-38 years) diagnosed with either cerebral palsy (n=44) or traumatic brain injury (n=56). Studies analysed block-starts (n=3), overground sprinting (n=3) and submaximal running (n=2), and submaximal treadmill running (n=1). Horizontal velocity during starts, sprinting and self-selected submaximal speeds were lower in RBI. During sprinting and submaximal running, compared with NDR, RBI had shorter stride length, step length, and flight time, increased ground-contact time, increased cadence, and reduced ankle and hip range of motion. In submaximal running, RBI had decreased ankle-power generation at toe-off. Conclusions: There is limited research and small sample sizes in this area. However, preliminary evidence suggests that RBI had lower sprint speeds and biomechanical characteristics typical of submaximal running speeds in NDR, including increased ground-contact times and reduced stride length, step length, and flight times. Meaningful interpretation of biomechanical findings in RBI is impeded by impairment variability (type, severity and distribution), and methods which permit valid, reliable impairment stratification in larger samples are required.

PMID: 32507448

7. Retinal Optical Coherence Tomography for Children With Cerebral Palsy
Cathy Williams

Dev Med Child Neurol. 2020 Jun 7. doi: 10.1111/dmcn.14584. Online ahead of print.

PMID: 32506569

8. Effects of an Intensive Voice Treatment on Articulatory Function and Speech Intelligibility in Children With Motor Speech Disorders: A Phase One Study
Colette Langlois, Benjamin V Tucker, Ashley N Sawatzky, Alesha Reed, Carol A Boliek

J Commun Disord. Jul-Aug 2020;86:106003. doi: 10.1016/j.jcomdis.2020.106003. Epub 2020 May 26.

Producing speech that is clear, audible, and intelligible to others is a challenge for many children with cerebral palsy (CP) and children with Down syndrome (DS). Previous studies have demonstrated the effectiveness of using the Lee Silverman Voice Treatment (LSVT LOUD®) to increase vocal loudness and improve speech intelligibility in individuals with dysarthria secondary to Parkinson's disease (PD), and some research suggests that it also may be effective for individuals with dysarthria

secondary to other conditions, including CP and DS. Although LSVT LOUD targets healthy vocal loudness, there is some evidence of spreading effects to the articulatory system. Acoustic data from two groups of children with secondary motor speech disorders [one with CP (n = 17) and one with DS (n = 9)] who received a full dose of LSVT LOUD and for whom post-treatment intelligibility gains have been previously reported, were analyzed for treatment effects on: 1) vowel duration, 2) acoustic vowel space and 3) the ratio of F2/i/ to F2/u/. Statistically significant changes in vowel duration and acoustic vowel space occurred pre-treatment to 12 weeks post-treatment in the CP group, and increased acoustic vowel space was observed in 5 of the DS participants. The present study provides preliminary evidence of intensive voice treatment spreading effects to the articulatory system in some children with CP and children with DS consistent with previous findings in other populations.

PMID: 32505858

9. Reliability and Validity of the Eating and Drinking Ability Classification System in Adults With Cerebral Palsy
Sung Eun Hyun, You Gyoung Yi, Hyung-Ik Shin

Dysphagia. 2020 Jun 9. doi: 10.1007/s00455-020-10141-y. Online ahead of print.

The Eating and Drinking Ability Classification System (EDACS) was developed to evaluate dysphagia in children with cerebral palsy (CP). This study aimed to investigate the interrater reliability and validity of the EDACS in adults with CP. This cross-sectional study included 117 community-dwelling adults (mean age, 37.9 ± 12.5 years) with a confirmed CP diagnosis. A swallowing occupational therapist (SwOT) conducted detailed interviews with participants and/or caregivers to classify the EDACS. Another SwOT and participants/caregivers evaluated the EDACS. Correlations were evaluated between the EDACS and Functional Oral Intake Scale (FOIS), Swallowing Quality of Life (SWAL-QOL), Gross Motor Function Classification System (GMFCS), and Manual Ability Classification System (MACS). Interrater reliabilities between SwOTs ($\kappa = 0.866$, intraclass correlation coefficient (ICC) = 0.867), and between SwOT and participant/caregiver ($\kappa = 0.884$, ICC = 0.717) were reported. The EDACS correlated with the FOIS, SWAL-QOL, and MACS, although no significant correlation was found with the GMFCS. The EDACS of spastic-type showed better correlation than that of dyskinetic-type with the FOIS, MACS, and GMFCS. There was a significant correlation between the EDACS and the GMFCS in those aged ≤ 30 years, whereas there was no correlation in those aged ≥ 30 years. The EDACS is a reliable and valid tool for classifying eating and drinking ability in adults with CP. The correlation between the EDACS with gait or hand function was more prominent in individuals with spastic CP and in younger individuals. The EDACS is a valuable adjunct to comprehensive functional classification in adults with CP.

PMID: 32519149

10. Comparison of Salivary Cytokines Levels Among Individuals With Down Syndrome, Cerebral Palsy and Normoactive
Carolina-Hartung Habibe, Rosemeire-Arai Yoshida, Renata Gorjão, Gabriela-Mancia de Gutierrez, Debora Heller, Alexander Birbrair, Maria-Teresa-Botti-Rodrigues Santos

J Clin Exp Dent. 2020 May 1;12(5):e446-e451. doi: 10.4317/jced.56336. eCollection 2020 May.

Background: Individuals with Down syndrome (DS) present increased susceptibility to infections and high prevalence of periodontal disease. The objective of this study is to evaluate the salivary concentrations of IL-1β, IL-6, IL-8, IL-10, TNFα and IL-12p70 of DS individuals and compare to cerebral palsy (CP) and normoactive patients (all with gingivitis). Material and methods: Twenty-two individuals with DS, 24 with CP and 22 normoactive participated in this cross-sectional study. Salivary flow rate, osmolality rate, Oral Hygiene Index, Gingival Index (GI) and salivary inflammatory markers IL-1β, IL-6, IL-8, IL-10, TNFα and IL-12p70 were evaluated. Shapiro-Wilks, Chi-square, ANOVA One-Way and Kruskal Wallis tests were applied with significance level at 5%. Results: The groups were homogenous for gender, age, and IL12p70 cytokine ($p>0.05$). GI was significantly higher in DS compared to CP and healthy ($p<0.05$). CP presented reduced salivary flow and increased osmolality rate. CP showed significantly higher values for TNFα, IL10, and IL6 compared to DS and normoactive ($p<0.05$). DS and CP presented significantly higher values of IL-1β and IL8 compared to normoactive ($p<0.05$). Conclusions: Individuals with CP have higher risk to develop periodontal disease due to reduced salivary flow rate, increased salivary osmolality rate and elevated TNFα, IL-10, IL-6 compared to DS.

PMID: 32509226

11. Complex Comorbid Presentations Are Associated With Harmful Behavior Problems Among Children and Adolescents With Cerebral Palsy
Geraldine Leader, Paola Molina Bonilla, Katie Naughton, Leanne Maher, Mia Casburn, Sophia Arndt, Arlene Mannion

Dev Neurorehabil. 2020 Jun 7;1-10. doi: 10.1080/17518423.2020.1770353. Online ahead of print.

Aim: Frequency and relationship between gastrointestinal symptoms, sleep problems, internalizing and externalizing symptoms, behavior problems and autism spectrum disorder (ASD) symptoms, and predictors of behavior problems were examined in children and adolescents with Cerebral Palsy (CP). Method: Parents of 104 children and adolescents with CP completed the Gastrointestinal Symptom Inventory, Children's Sleep Habits Questionnaire, Child Behavior Checklist, Social Communication Questionnaire and the Behavior Problem Inventory-Short Form. Results: High frequency of behavior problems (88.5%), gastrointestinal symptoms (81.7%), sleep problems (81%) ASD symptoms (48%) and internalizing and externalizing symptoms (31.7%) were found. Relationships were found between gastrointestinal symptoms and sleep problems, and gastrointestinal symptoms and internalizing and externalizing symptoms. Relationships were found between sleep problems and behavior problems. Intellectual disability, sleep problems, internalizing and externalizing symptoms, and ASD symptoms predicted behavior problems. Conclusion: Findings highlights the frequency of comorbidities that exist in CP and how these comorbidities affect one another.

PMID: 32508226

12. Prevalence of Children Aged 3-17 Years With Developmental Disabilities, by Urbanicity: United States, 2015-2018
Benjamin Zablotsky, Lindsey I Black

Natl Health Stat Report. 2020 Feb;(139):1-7.

Objective-This report examines the prevalence of developmental disabilities among children in both rural and urban areas as well as service utilization among children with developmental issues in both areas. Methods-Data from the 2015-2018 National Health Interview Survey (NHIS) were used to examine the prevalence of 10 parent- or guardian-reported developmental disability diagnoses (attention-deficit/hyperactivity disorder [ADHD], autism spectrum disorder, blindness, cerebral palsy, moderate to profound hearing loss, learning disability, intellectual disability, seizures, stuttering or stammering, and other developmental delays) and service utilization for their child. Prevalence estimates are presented by urbanicity of residence (urban or rural). Bivariate logistic regressions were used to test for differences by urbanicity. Results-Children living in rural areas were more likely to be diagnosed with a developmental disability than children living in urban areas (19.8% compared with 17.4%). Specifically, children living in rural areas were more likely than those in urban areas to be diagnosed with ADHD (11.4% compared with 9.2%) and cerebral palsy (0.5% compared with 0.2%). However, among children with a developmental disability, children living in rural areas were significantly less likely to have seen a mental health professional, therapist, or had a well-child checkup visit in the past year, compared with children living in urban areas. Children with a developmental disability living in rural areas were also significantly less likely to receive Special Educational or Early Intervention Services compared with those living in urban areas. Conclusion-Findings from this study highlight differences in the prevalence of developmental disabilities and use of services related to developmental disabilities by rural and urban residence.

PMID: 32510313

13. Parental Perspectives on Care for Sleep in Children With Cerebral Palsy: A Wake-Up Call
Raquel Y Hulst, Jeanine M Voorman, Sigrid Pillen, Marjolijn Ketelaar, Johanna M A Visser-Meily, Olaf Verschuren

Disabil Rehabil. 2020 Jun 12;1-10. doi: 10.1080/09638288.2020.1770873. Online ahead of print.

Purpose: Sleep problems are common in children with cerebral palsy (CP) and have a large impact on child health and family functioning. This qualitative study aimed to explore parental perspectives regarding the care for sleep of their young child (age 1-8 years) with CP.Materials and methods: Individual, semi-structured interviews were conducted with eighteen parents of a child with CP (GMFCS levels I-V). Inductive thematic analysis of the data was performed within each of the three preidentified domains: 1) Current situation; 2) Concerns; 3) Needs.Results: In total, sixteen themes were identified across the

three domains. Within the families' Current situation, parents expressed various issues concerning the care for sleep of their child both at night and during daytime, which are hampered by perceived deficiencies in healthcare, such as limited attention for sleep and lack of knowledge among health professionals. Themes within the Concerns and Needs domains encompassed experiences in the home environment relating to child, family and social aspects, while experiences in the healthcare setting included clinical practices and attitudes of healthcare professionals, as well as the broader organisation of care for sleep.Conclusions: Parents face numerous challenges caring for their child's sleep and the burden placed on families by sleep problems is underappreciated. In order to break the vicious circle of sleep problems and their disastrous consequences on the wellbeing of families, we need to wake up to parent-identified issues and shortcomings in healthcare. Care for sleep should be integrated into paediatric rehabilitation through routine inquiries, using a family-centered and multidisciplinary approach.IMPLICATIONS FOR REHABILITATIONThe heavy burden placed on families by sleep problems in children with cerebral palsy warrants acknowledgement in paediatric healthcare.Sleep should be routinely addressed by clinicians during health assessments using a family-centered, and multidisciplinary approach.Healthcare professionals ought to adopt a proactive, understanding, and non-judgmental attitude when addressing sleep problems.Future research should focus on developing sleep intervention strategies that take into account the diverse parental concerns and needs unique to each family situation.

PMID: 32530772

14. Sleep Surgery in Syndromic and Neurologically Impaired Children
Noor-E-Seher Ali, Jennifer C Alyono, Anisha R Kumar, Hanrong Cheng, Peter J Koltai

Am J Otolaryngol. 2020 May 27;41(4):102566. doi: 10.1016/j.amjoto.2020.102566. Online ahead of print.

Purpose: To examine surgery performed for obstructive sleep apnea (OSA) in children with syndromic or neurologic comorbidities. Material and methods: Medical records of 375 children with OSA were retrospectively reviewed, including 142 patients with trisomy 21, 105 with cerebral palsy, 53 with muscular dystrophy, 32 with spinal muscular atrophy, 18 with mucopolysaccharidoses, 14 with achondroplasia, and 11 with Prader-Willi. Outcome measures: Apnea-hypopnea index (AHI), complications, length of postoperative stay, and endoscopic findings. Results: 228 patients received 297 surgical interventions, with the remainder undergoing observation or positive pressure ventilation. Adenoidectomy was the most common procedure performed (92.1% of patients), followed by tonsillectomy (91.6%). Average AHI decreased following tonsillectomy, from 12.4 to 5.7 ($p = 0.002$). The most common DISE finding was the tongue base causing epiglottic retroflexion. Lingual tonsillectomy also resulted in an insignificant decrease in the AHI. Conclusions: Adenotonsillectomy, when there is hypertrophy, remains the mainstay of management of syndromic and neurologically-impaired children with OSA. However, additional interventions are often required, due to incomplete resolution of the OSA. DISE is valuable in identifying remaining sites of obstruction and guiding future management.

PMID: 32504854

15. Brain Metabolism During A Lower Extremity Voluntary Movement Task in Children With Spastic Cerebral Palsy
Eileen G Fowler, William L Oppenheim, Marcia B Greenberg, Loretta A Staudt, Shantanu H Joshi, Daniel H S Silverman

Front Hum Neurosci. 2020 May 25;14:159. doi: 10.3389/fnhum.2020.00159. eCollection 2020.

Reduced selective voluntary motor control (SVMC) is a primary impairment due to corticospinal tract (CST) injury in spastic cerebral palsy (CP). There are few studies of brain metabolism in CP and none have examined brain metabolism during a motor task. Nine children with bilateral spastic CP [Age: 6-11 years, Gross Motor Function Classification System (GMFCS) Levels II-V] completed this study. SVMC was evaluated using Selective Control Assessment of the Lower Extremity (SCALE) ranging from 0 (absent) to 10 (normal). Brain metabolism was measured using positron emission tomography (PET) scanning in association with a selective ankle motor task. Whole brain activation maps as well as ROI averaged metabolic activity were correlated with SCALE scores. The contralateral sensorimotor and superior parietal cortex were positively correlated with SCALE scores ($p < 0.0005$). In contrast, a negative correlation of metabolic activity with SCALE was found in the cerebellum ($p < 0.0005$). Subsequent ROI analysis showed that both ipsilateral and contralateral cerebellar metabolism correlated with SCALE but the relationship for the ipsilateral cerebellum was stronger ($R 2 = 0.80$, $p < 0.001$ vs. $R 2 = 0.46$, $p = 0.045$). Decreased cortical and increased cerebellar activation in children with less SVMC may be related to task difficulty, activation of new motor learning paradigms in the cerebellum and potential engagement of alternative motor systems when CSTs are focally damaged. These results support SCALE as a clinical correlate of neurological impairment.

PMID: 32528261

16. Monitoring Improvement in Infantile Cerebral Palsy Patients Using the 4DBODY System-A Preliminary Study
Krzysztof Krasowicz, Jakub Michoński, Paweł Liberadzki, Robert Sitnik

Sensors (Basel). 2020 Jun 6;20(11):E3232. doi: 10.3390/s20113232.

Monitoring the patient's condition during rehabilitation is the key to success in this form of treatment. This is especially important in patients with infantile cerebral palsy (ICP). Objective assessment can be achieved through modern optical measurement techniques. The 4DBODY system allows to capture dynamic movement with high accuracy. Eight patients with ICP participated in the study. The group underwent therapy lasting seven days using neurodevelopmental treatment (NDT) and functional training (FT). The patients' condition was monitored by the 4DBODY system. The measurements were taken three times: before the therapy, after, and then again after one week. We have developed the Trunk Mobility in the Frontal Plane Index (TMFPI) for its assessment. The results were compared with a score obtained using the Gross Motor Function Measure scale (GMFM 88). An improvement of the TMFPI parameter was observed in five patients, inconsistent results in two and deterioration in one. The reference GMFM score was higher in all patients relative to pre-treatment values. We found that surface scanning with the 4DBODY system allows to precisely track body movement in ICP patients. The decrease in the TMFPI parameter reflects the improvement in the dysfunction of body alignment, balance and symmetry of movement on the L and R body side.

PMID: 32517193

17. Baclofen Pump With Pre-Brainstem Catheter Tip Placement: Technical Note and Case Series
Amparo Saenz, Miguel Grijalba, Juan Pablo Mengide, Romina Argañaraz, Fernando Ford, Beatriz Mantese

Childs Nerv Syst. 2020 Jun 6. doi: 10.1007/s00381-020-04679-3. Online ahead of print.

Purpose: This study aims to describe a new baclofen pump implantation technique with pre-brainstem catheter placement and to demonstrate the benefits that this procedure has in treating spasticity and dystonia. Methods: We described a new technique to place a baclofen pump catheter anterior to the brainstem. To illustrate the technique, we presented five patients with both spasticity and dystonia in whom conventional treatment was not effective. They each received a baclofen pump with a pre-brainstem catheter. We evaluated the results using the Ashworth scale for spasticity, the Barry-Albright scale for dystonia, and the PedsQL for quality of life assessment. Each patient was evaluated before a surgery and after 6 months of follow-up. Results: There were statistically significant differences in all the physical examination evaluated areas using the Barry-Albright and modified Ashworth scales between the preoperative and the postoperative period. The same applies to the results of the PedsQL quality of life scale. Conclusion: We presented an innovative baclofen pump implantation technique with pre-brainstem catheter placement that could be a therapeutic alternative in patients with dystonia and spastic quadriparesis for whom conventional therapy is not effective.

PMID: 32504173

18. Breath Indeed Carries Significant Information About a Disease. Potential Biomarkers of Cerebral Palsy
Kiran Sankar Maiti, Susmita Roy, Renée Lampe, Alexander Apolonski

J Biophotonics. 2020 Jun 11;e202000125. doi: 10.1002/jbio.202000125. Online ahead of print.

Objective and reliable non-invasive medical diagnostics of a large variety of diseases is still a dream. As a step in the direction of realization, a spectroscopic breath study of cerebral palsy (CP) was performed. Principal component analysis revealed data clustering for a healthy group and CP individuals was observed, with a p-value below 10-5 . Learning algorithms resulted in 91 % accuracy in distinguishing the groups. With the help of manual analysis of absorption spectral features of breath samples,

two volatile organic compounds were identified that demonstrate significant deviations in the groups. These represent two esters of propionic acid (PPAE). A transportation scheme was hypothesized that links the gut where propionic acid (PPA) and PPAE are produced, the brain of CP patients, through which PPA and PPAE transmit, and the lungs where PPAE releases. The results show a possibility to detect one more brain-related disorder via breath, in this case CP.

PMID: 32526081

19. Impact of Inhaled Corticosteroids on the Neurodevelopmental Outcomes in Chronically Ventilated Extremely Low Birth Weight Preterm Infants
Ngiik-Ping Tiong, Chun-Chih Peng, Mary Hsin-Ju Ko, Kai-Ti Tseng, Jui-Hsing Chang, Chyong-Hsin Hsu, Yi-Hsiang Sung, Hung-Yang Chang

J Formos Med Assoc. 2020 Jun 2;S0929-6646(20)30205-9. doi: 10.1016/j.jfma.2020.05.015. Online ahead of print.

Background: Few studies have assessed the long-term impact of inhaled corticosteroids (ICS) in preterm infants. This study evaluated the neurodevelopmental outcomes of chronically ventilated extremely low birth weight (ELBW) preterm infants exposed to ICS. Methods: The medical records of ELBW preterm infants admitted to two tertiary-level neonatal intensive care units from 2008 to 2014 were reviewed. Infants intubated for more than 28 days were included. The neurodevelopmental outcomes were compared at 24 months corrected age, between those with ICS exposure (inhaled group, IH) and those without it (non-inhaled group, NIH), by using the Bayley-Scale-of-Infant-and-Toddler Development-III (BSID-III). Results: Out of the 115 infants included, 64 had an ICS exposure. The incidence of the morbidities at the time of discharge, was comparable between the two groups, except for the duration of oxygen and mechanical ventilation dependence (IH 124.8 ± 40.3 days vs. NIH: 101.0 ± 28.6 days, $p < 0.001$ and IH 60.0 ± 25.8 days vs. NIH: 42.3 ± 14.2 days, $p < 0.001$, respectively). Multiple logistic regression analysis at 24 months corrected age revealed no significant differences in the BSID-III scores and in the incidence of cerebral palsy and neurodevelopmental impairment. Conclusions: The late ICS exposure was not associated with neurodevelopmental impairment at 24 months corrected age in chronically ventilated ELBW infants; however, it did not reduce the duration of their dependence on oxygen and mechanical ventilation.

PMID: 32507344

20. The Role of the Placenta in Perinatal Stroke: A Systematic Review
Bithi Roy, Susan Arbuckle, Karen Walker, Catherine Morgan, Claire Galea, Nadia Badawi, Iona Novak

J Child Neurol. 2020 Jun 9;883073820929214. doi: 10.1177/0883073820929214. Online ahead of print.

Context: Placental pathology may be an important missing link in the causal pathway of perinatal stroke. The study aim was to systematically review the literature regarding the role of the placenta in perinatal stroke. MEDLINE, Embase, Scopus, and Web of Science electronic databases were searched from 2000 to 2019. Studies were selected based on predefined criteria. To enable comparisons, placental abnormalities were coded using Redline's classification. Results: Ten studies met the inclusion criteria. Less than a quarter of stroke cases had placental pathology reported. Placental abnormalities were more common among children with perinatal stroke than in the control group. The most frequent placental abnormality was Redline's category 2 (thrombo-inflammatory process). Conclusions: Placental abnormalities appear to be associated with perinatal stroke, supporting additional indirect evidence and biological plausibility of a causative role. However, the results should be interpreted cautiously considering the low frequency of placental examination and lack of uniformity in placental pathology reporting. Clinical trial registration: PROSPERO Registration no: CRD42017081256.

PMID: 32516012

Prevention and Cure

21. The Small Molecule P7C3-A20 Exerts Neuroprotective Effects in a Hypoxic-ischemic Encephalopathy Model via Activation of PI3K/AKT/GSK3β Signaling
Junjie Bai, Shanshan Zeng, Jinjin Zhu, Changchang Fu, Minzhi He, Jianghu Zhu, Shangqing Chen, Xiaoqin Fu, Peijun Li, Zhenlang Lin

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Hypoxic-ischemic encephalopathy (HIE) in neonates can lead to severe long-term disabilities including cerebral palsy and brain injury. The small molecule P7C3-A20 has been shown to exert neuroprotective effects in various disorders such as ischemic stroke and neurodegenerative diseases. However, it is unclear whether P7C3-A20 has therapeutic potential for the treatment of HIE, and the relationship between P7C3-A20 and neuronal apoptosis is unknown. To address these questions, the present study investigated whether P7C3-A20 reduces HI injury in vitro using a PC12 cell oxygen-glucose deprivation (OGD) model and in vivo in postnatal day 7 and 14 rats subjected to HI, along with the underlying mechanisms. We found that treatment with P7C3-A20 (40-100 μM) alleviated OGD-induced apoptosis in PC12 cells. In HI model rats, treatment with 5 or 10 mg/kg P7C3-A20 reduced infarct volume; reversed cell loss in the cortex and hippocampus and improved motor function without causing neurotoxicity. The neuroprotective effects were abrogated by treatment with the phosphatidylinositol 3-kinase (PI3K) inhibitor LY294002. These results demonstrate that P7C3-A20 exerts neuroprotection by activating PI3K/protein kinase B/glycogen synthase kinase 3β signaling and can potentially be used to prevent brain injury in neonates following HIE.

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22. Antenatal Corticosteroids and Preterm Offspring Outcomes in Hypertensive Disorders of Pregnancy: A Japanese Cohort Study
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To estimate whether antenatal corticosteroids (ACS) improve short- and long-term preterm offspring outcomes in singleton pregnancies complicated by hypertensive disorders of pregnancy (HDP) similar to pregnancies without HDP. This population-based retrospective study was conducted based on an analysis of data collected by the Neonatal Research Network of Japan on 21,014 singleton neonates weighing ≤1,500 g between 24 and 31 weeks' gestation during 2003-2016. Logistic regression analyses were performed to compare short- and long-term offspring outcomes between mothers receiving ACS treatment and those who did not among pregnancies with HDP and without HDP. Of 21,014 neonates, 4,806 (22.9%) were born to mothers with HDP. ACS treatment was associated with significant decreases in short-term adverse outcomes in the both HDP and non-HDP groups, with similar reduced odds of neonatal death, respiratory distress syndrome, and intraventricular haemorrhage (IVH). However, ACS treatment did not significantly decrease severe IVH (aOR 0.76; 95% CI 0.51-1.13) and periventricular leukomalacia (1.14; 0.78-1.66) in the HDP group. In addition, ACS treatment in mothers without HDP significantly decreased cerebral palsy (aOR 0.70; 95% CI 0.58-084), developmental quotient scores <85 (0.79; 0.69-0.90), and composite adverse outcomes (0.85; 0.75-0.96) at 3 years of age, whereas ACS treatment in mothers with HDP did not significantly improve these outcomes (1.04; 0.69-1.57, 1.11; 0.88-1.39, 0.96; 0.75-1.22, respectively). ACS treatment was associated with significantly decreased major short-term morbidities and mortality among extremely and very preterm neonates of mothers with HDP, with ACS treatment having a decreased effect compared to that observed in neonates of mothers without HDP. Although ACS treatment has no additional effects on offspring outcomes at 3 years of age, our results did not suggest that ACS treatment should be withheld from mothers with HDP.

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