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## Interventions and Management

### 1. Stroke. 2016 May 10. pii: STROKEAHA.116.013545. [Epub ahead of print]

Does Contralesional Hand Function After Neonatal Stroke Only Depend on Lesion Characteristics?

Dinomais M, Hertz-Pannier L, Groeschel S, Delion M, Husson B, Kossorotoff M, Renaud C, Chabrier S, The Tich SN; AVCnn Study Group.

**BACKGROUND AND PURPOSE:** In children having suffered from neonatal arterial ischemic stroke, the relationship between contralesional hand performance and structural changes in brain areas remote from the infarct site was examined. **METHODS:** Using voxel-based morphometry, we correlated contralesional gross manual dexterity assessed by the box and block test and whole-brain gray and white-matter volume changes on high-resolution magnetic resonance imaging in 37 7-year-old post-neonatal arterial ischemic stroke children. We also compared the volume of the identified structures with magnetic resonance imaging data of 10 typically developing age-matched children. **RESULTS:** Areas showing the highest positive correlation with the box and block test scores were ipsilesional mediodorsal thalamus, contralesional cerebellar lobule VIIa Crus I, and ipsilesional corticospinal tract at the level of superior corona radiata, the posterior limb of the internal capsule, and the cerebral peduncle and the ipsilesional body of corpus callosum. When compared with typically developing age-matched children, post-neonatal arterial ischemic stroke children with severe contralesional hand motor deficit exhibited significant volume reductions in these structures (except the cerebellum), whereas no differences were found with those with good manual dexterity. No negative correlation was found between box and block test scores and brain areas. **CONCLUSIONS:** Contralesional hand performance after neonatal arterial ischemic stroke is correlated with atrophy in brain areas directly or functionally connected but anatomically remote from the infarct. Our study suggests a role of the cerebellar lobule VIIa Crus I and mediodorsal thalamus in manual dexterity.

[PMID: 27165960](#)

### 2. IEEE Trans Neural Syst Rehabil Eng. 2016 Apr 29. [Epub ahead of print]

Development of an EMG-ACC-Based Upper Limb Rehabilitation Training System.

Liu L, Chen X, Lu Z, Cao S, Wu, Zhang X.

This paper focuses on the development of an upper limb rehabilitation training system designed for use by children with cerebral palsy (CP). It attempts to meet the requirements of in-home training by taking advantage of the combination of portable accelerometers (ACC) and surface electromyography (SEMG) sensors worn on the upper limb to capture functional movements. In the proposed system, the EMG-ACC acquisition device works essentially as wireless game controller, and three rehabilitation games were designed for improving upper limb motor function under a clinician's guidance. The games were developed on the Android platform based on a physical engine called Box2D. The results of a system performance test demonstrated that the developed games can respond to the upper limb actions within 210ms. Positive questionnaire feedbacks from twenty CP subjects who participated in the game test verified both the feasibility and usability of the system. Results of a

long-term game training conducted with three CP subjects demonstrated that CP patients could improve in their game performance through repetitive training, and persistent training was needed to improve and enhance the rehabilitation effect. According to our experimental results, the novel multi-feedback SEMG-ACC-based user interface improved the users' initiative and performance in rehabilitation training.

[PMID: 27164594](#)

### 3. *Pediatr Exerc Sci.* 2016 May 13. [Epub ahead of print]

The Effect of Handcycle Ergometer Exercise on Glucose Tolerance in Ambulatory and Non-Ambulatory Adolescents.

Short KR, Teague AM, Klein JC, Malm-Buatsi E, Frimberger D.

**PURPOSE:** Whole body or leg exercise before a meal can increase insulin sensitivity, but it is unclear whether the same can occur with upper body exercise since a smaller muscle mass is activated. We measured the impact of a single session of handcycle exercise on glucose tolerance and insulin sensitivity. **METHODS:** Non-ambulatory (Non-Amb) adolescents with spina bifida or cerebral palsy (4F/3M), or ambulatory peers (Control, 4F/7M) completed two glucose tolerance tests on separate days, preceded by either rest or a 35-minute bout of moderate-to-vigorous intermittent handcycle exercise. **RESULTS:** The Non-Amb group had higher body fat (mean  $\pm$  SD: 38 $\pm$ 12%, Control: 24 $\pm$ 9,  $p=0.041$ ) but similar VO<sub>2</sub>peak (17.7 $\pm$ 6.1 ml/kg/min, Control: 21.1 $\pm$ 7.9). Fasting glucose and insulin were normal for all participants. Compared to the rest trial, exercise resulted in a reduction in glucose area under the curve (11%,  $p = 0.008$ ) without a significant group  $\times$  trial interaction and no difference in the magnitude of change between groups. Insulin sensitivity was increased 16% ( $p=0.028$ ) by exercise in the Control group but was not significantly changed in the Non-Amb group. **CONCLUSION:** A single bout of handcycle exercise improves glucose tolerance in adolescents with and without mobility limitations and could therefore help maintain or improve metabolic health.

[PMID: 27176627](#)

### 4. *J Exerc Rehabil.* 2016 Apr 26;12(2):124-31. doi: 10.12965/jer.1632552.276. eCollection 2016.

Metabolic, cardiorespiratory, and neuromuscular fitness performance in children with cerebral palsy: A comparison with healthy youth.

García CC, Alcocer-Gamboa A, Ruiz MP, Caballero IM, Faigenbaum AD, Esteve-Lanao J, Saiz BM, Lorenzo TM, Lara SL.

The aim of this study was to assess metabolic, cardiorespiratory, and neuromuscular fitness parameters in children with spastic cerebral palsy (CP) and to compare these findings with typically developing children. 40 children with CP (21 males, 19 females; mean age, 11.0 $\pm$ 3.3 yr; range, 6.5-17.1 yr; Gross Motor Function Classification System levels 1 or 2) and 40 healthy, age- and sex-matched children completed a test battery that consisted of 8 tests and 28 measures that assessed cardiorespiratory fitness, energy expenditure, anaerobic endurance, muscle strength, agility, stability and flexibility. Children with CP had significantly lower performance ( $P<0.05$ ) on most cardiorespiratory and metabolic tests than those of healthy children. Differences in neuromuscular measures of muscular strength, speed, agility, anaerobic endurance, and flexibility between groups were most apparent. Grouped differences in cardiorespiratory variables revealed a 25% difference in performance, whereas grouped differences in metabolic and neuromuscular measures were 43% and 60%, respectively. The physical fitness of contemporary children with CP is significantly less than healthy, age-matched children. Significant differences in neuromuscular measures between groups can aid in the identification of specific fitness abilities in need of improvement in this population.

[PMID: 27162775](#)

### 5. Acta Chir Orthop Traumatol Cech. 2016;83(2):106-10.

[Extraarticular Subtalar Arthrodesis with the Grice Procedure in Children with Cerebral Palsy: Mid-Term Results].  
[Article in Czech]

Němejcová E, Schejbalová A, Trč T, Havlas V.

**PURPOSE OF THE STUDY** The aim of the study was to evaluate, on the basis of radiographic findings and AOFAS scores, the results of the Grice extra-articular subtalar arthrodesis for treatment of planovalgus foot deformity in cerebral palsy patients. **MATERIAL AND METHODS** A total of 38 patients (50 feet) with cerebral palsy indicated to the Grice procedure for planovalgus foot deformity between 2006 and 2010 were assessed. The group comprised 18 girls and 20 boys, of whom 10 had spastic quadriplegia (four undergoing bilateral surgery), three had triplegia, four had hemiplegia and 21 had diplegia (treated on both sides in eight). The average age at surgery was 12 years (range, 7 years and 2 months to 17 years and 8 months). All patients were evaluated based on the AOFAS scoring system and radiographic findings before and after surgery. **RESULTS** The average follow-up was 4.5 years. The average AOFAS score increased from 54.9 points pre-operatively to 76.6 points post-operatively. The pre- and post-operative average values for the talocalcaneal angle were 49.8° and 25°, respectively; for the calcaneal inclination angle they were 8.6° and 13.4°, respectively. **DISCUSSION** The Grice procedure has long been considered a primary surgical treatment for planovalgus foot deformity in patients with cerebral palsy. Recently, calcaneal osteotomy has been used more frequently, but with no evidence of provably better results. **CONCLUSIONS** The mid-term results of the Grice extra-articular arthrodesis in our group of cerebral palsy children were very good in terms of both radiographic and AOFAS score evaluation; the latter includes objective assessment as well as the patient's subjective evaluation.

[PMID: 27167415](#)

### 6. Medicine (Baltimore). 2016 May;95(19):e3649. doi: 10.1097/MD.0000000000003649.

A Prospective Case-Control Study of Radial Extracorporeal Shock Wave Therapy for Spastic Plantar Flexor Muscles in Very Young Children With Cerebral Palsy.

Wang T, Du L, Shan L, Dong H, Feng J, Kiessling MC, Angstman NB, Schmitz C, Jia F.

To assess the effects of radial extracorporeal shock wave therapy (rESWT) on plantar flexor muscle spasticity and gross motor function in very young patients with cerebral palsy (CP). The design was case-control study (level of evidence 3). The setting was the Department of Pediatric Neurology and Neurorehabilitation, First Hospital of Jilin University, Changchun, China. Those with a diagnosis of CP and spastic plantar flexor muscles were recruited between April 2014 and April 2015. According to the parents' decision, patients received 1 ESWT session per week for 3 months, with 1500 radial shock waves per ESWT session and leg with positive energy flux density of 0.03 mJ/mm, combined with traditional conservative therapy (rESWT group) or traditional conservative therapy alone (control group). The Modified Ashworth Scale (MAS) (primary outcome measure) and passive range of motion (pROM) measurements were collected at baseline (BL), 1 month (M1), and 3 months (M3) after BL. The Gross Motor Function Measure (GMFM)-88 was collected at BL and M3. Sixty-six patients completed the final review at 3 months and were included in the study. Subjects ranged in age from 12 to 60 months (mean age 27.0±13.6 months; median age 22.0 months; 33.3% female). For the rESWT group (n=34), mean MAS grades at BL, M1, and M3 were 2.6, 1.9, and 1.5 on the left side and 1.9, 1.7, and 1.2 on the right side. For the control group (n=32), mean MAS grades at BL, M1, and M3 were 2.5, 2.4, and 2.1 on the left side and 1.8, 1.8, and 1.5 on the right side. The within-subject effects time×side and time×treatment were statistically significant (P<0.01). Similar results were found for the improvement of mean pROM. GMFM-88 improved from BL to M3, but showed no statistically significant difference between the groups. There were no significant complications. This study demonstrates that the combination of rESWT and traditional conservative therapy is more effective than traditional conservative therapy alone in the treatment of spasticity in very young patients with CP.

[PMID: 27175689](#)

**7. Dev Med Child Neurol. 2016 May 12. doi: 10.1111/dmcn.13149. [Epub ahead of print]**

Lower limb muscle growth in unilateral and bilateral cerebral palsy.

Theis N.

[PMID: 27169544](#)

**8. Ann Phys Rehabil Med. 2016 May 3. pii: S1877-0657(16)30032-X. doi: 10.1016/j.rehab.2016.02.009. [Epub ahead of print]**

Clinical practices in intrathecal baclofen pump implantation in children with cerebral palsy in France.

Mietton C, Nuti C, Dohin B, Bayle B, Fernandez B, Poirot I, Gautheron V, Vuillerot C.

[PMID: 27158102](#)

**9. Eur Spine J. 2016 May 6. [Epub ahead of print]**

Intrathecal baclofen pumps do not accelerate progression of scoliosis in quadriplegic spastic cerebral palsy.

Rushton PR, Nasto LA, Aujla RK, Ammar A, Grevitt MP, Vloeberghs MH.

**PURPOSE:** To compare scoliosis progression in quadriplegic spastic cerebral palsy with and without intrathecal baclofen (ITB) pumps. **METHODS:** A retrospective matched cohort study was conducted. Patients with quadriplegic spastic cerebral palsy, GMFCS level 5, treated with ITB pumps with follow-up >1 year were matched to comparable cases by age and baseline Cobb angle without ITB pumps. Annual and peak coronal curve progression, pelvic obliquity progression and need for spinal fusion were compared. **RESULTS:** ITB group: 25 patients (9 female), mean age at pump insertion 9.4 and Risser 0.9. Initial Cobb angle 25.6° and pelvic tilt 3.2°. Follow-up 4.3 (1.0-7.8) years. Cobb angle at follow-up 76.1° and pelvic tilt 18.9°. Non-ITB group: 25 patients (14 female), mean age at baseline 9.2 and Risser 1.0. Initial Cobb angle 29.7° and pelvic tilt 7.1°. Follow-up 3.5 (1.0-7.5) years. Cobb angle at follow-up 69.1° and pelvic tilt 21.0°. The two groups were statistically similar for baseline age, Cobb angle and Risser grade. Mean curve progression was 13.6°/year for the ITB group vs 12.6°/year for the non-ITB group ( $p = 0.39$ ). Peak curve progression was similar between the groups. Pelvic tilt progression was comparable; ITB group 4.5°/year vs non-ITB 4.6°/year ( $p = 0.97$ ). During follow-up 5 patients in the ITB group and 9 in the non-ITB group required spinal fusion surgery for curve progression ( $p = 0.35$ ). **CONCLUSIONS:** Patients with quadriplegic spastic cerebral palsy with and without ITB pumps showed significant curve progression over time. ITB pumps do not appear to alter the natural history of curve progression in this population.

[PMID: 27154169](#)

**10. Complement Ther Clin Pract. 2016 May;23:26-9. doi: 10.1016/j.ctcp.2016.02.002. Epub 2016 Feb 13.**

Horseback riding therapy in addition to conventional rehabilitation program decreases spasticity in children with cerebral palsy: A small sample study.

Alemdaroğlu E, Yanıkoğlu İ, Öken Ö, Uçan H, Ersöz M, Köseoğlu BF, Kapıcıoğlu Mİ.

**OBJECTIVE:** To evaluate the short-term effects of horseback riding therapy in addition to a conventional rehabilitation program in children with cerebral palsy. **METHODS:** Nine children receiving horseback riding therapy in addition to conventional rehabilitation (Group 1) and seven children receiving conventional rehabilitation alone (Group 2) were assessed at baseline and 5 weeks later. Assessed were: modified functional reach test (MFRT), hip abduction angle, the Ashworth Scale for hip adductor muscle spasticity, knee distance test, and the Gross Motor Function Classification System (GMFCS). **RESULTS:** The percentage change in hip adductor spasticity on the Ashworth Scale was 22% in Group 1 and 0% in Group 2 (significant difference;  $p = 0.016$ ). Comparison of changes on the MFRT, GMFCS, knee distance test and hip abduction angle showed that the differences between Groups 1 and 2 were not significant. **CONCLUSIONS:** In these children, horseback riding therapy in addition to conventional rehabilitation resulted in significant improvement in adductor spasticity on short-term follow-up.

[PMID: 27157954](#)

**11. Dev Med Child Neurol. 2016 May 12. doi: 10.1111/dmcn.13147. [Epub ahead of print]**

Reflections on the Functional Communication Classification System for children with cerebral palsy.

Hustad KC.

[PMID: 27169381](#)

**12. Eur J Paediatr Neurol. 2016 Apr 22. pii: S1090-3798(16)30014-9. doi: 10.1016/j.ejpn.2016.04.010. [Epub ahead of print]**

Management of drooling in children with cerebral palsy: A French survey.

Chaléat-Valayer E, Porte M, Buchet-Poyau K, Roumenoff-Turcant F, D'Anjou MC, Boulay C, Bernard JC, Touzet S.

AIM: To characterise children with cerebral palsy (CP) and pathological drooling in France, and to describe care pathways, assessment and treatment. METHOD: A transversal, observational, descriptive survey of the practices and opinions of 400 health professionals potentially involved in the care of children with CP, was carried out nationally across France in 2013. RESULTS: The response rate was 36%. Seventy-five questionnaires were returned and analysed (52%). A small proportion of children were specifically treated for drooling (<25%). Assessments were carried out in 75% of cases and 91% of professionals prescribed treatments. Use of assessment tools varied widely. The most common treatment was oro-facial rehabilitation (95% of professionals), followed by anticholinergic drugs (Scopolamine®) (94%) botulinum toxin injections (BT) (66%) and surgery (34%). Scopolamine was considered to be less effective than BT and to have more side effects. CONCLUSION: The rate of pathological drooling in children with CP is likely underestimated and under treated in France. There is a lack of knowledge regarding assessment tools. Aside from rehabilitation, current practice is to prescribe medication as the first-line treatment, however professionals consider that BT is more effective and has less side effects.

[PMID: 27155820](#)

## Prevention and Cure

### 13. Res Dev Disabil. 2016 May 7;55:256-267. doi: 10.1016/j.ridd.2016.04.005. [Epub ahead of print]

Single blind randomised controlled trial of GAME (Goals - Activity - Motor Enrichment) in infants at high risk of cerebral palsy.

Morgan C, Novak I, Dale RC, Guzzetta A, Badawi N.

**BACKGROUND:** Cerebral palsy (CP) is caused by a lesion in the developing infant brain. Recent neuroplasticity literature suggests that intensive, task-specific intervention ought to commence early, during the critical period of neural development. **AIMS:** To determine whether "GAME" (Goals - Activity - Motor Enrichment), a motor learning, environmental enrichment intervention, is effective for improving motor skills in infants at high risk of CP. **METHODS AND PROCEDURES:** Single blind randomised controlled trial of GAME versus standard care. Primary outcome was motor skills on the Peabody Developmental Motor Scales-2 (PDMS-2). Secondary outcomes included Canadian Occupational Performance Measure (COPM), Bayley Scales of Infant and Toddler Development (BSID-III) and Gross Motor Function Measure-66 (GMFM-66). Outcome assessors were masked to group allocation and data analyzed with multiple regression. **OUTCOMES AND RESULTS:** All n=30 infants enrolled received the assigned intervention until 16 weeks post enrolment. At 12 months of age, n=26 completed assessments. Significant between group differences were found in raw scores on the PDMS-2 in favour of GAME (B=20.71, 95%CI 1.66-39.76, p=0.03) and at 12 months on the total motor quotient (B=8.29, 95%CI 0.13-16.45, p=0.05). Significant between group differences favored GAME participants at 12 months on the cognitive scale of the BSID-III and satisfaction scores on the COPM. **CONCLUSION:** GAME intervention resulted in advanced motor and cognitive outcomes when compared with standard care.

[PMID: 27164480](#)

### 14. Neurotoxicology. 2016 May 3. pii: S0161-813X(16)30066-3. doi: 10.1016/j.neuro.2016.05.001. [Epub ahead of print]

Burden of Neurological Conditions in Canada.

Gaskin J, Gomes J, Darshan S, Krewski D.

Neurological conditions are among the leading causes of disability in the Canadian population and are associated with a large public health burden. An increase in life expectancy and a declining birth rate has resulted in an aging Canadian population, and the proportion of age-adjusted mortality due to non-communicable diseases has been steadily increasing. These conditions are frequently associated with chronic disability and an increasing burden of care for patients, their families and caregivers. The National Population Health Study of Neurological Conditions (NPHSNC) aims to improve knowledge about neurological conditions and their impacts on individuals, their families, caregivers and health care system. The Systematic Review of Determinants of Neurological Conditions, a specific objective within the NPHSNC, is a compendium of systematic reviews on risk factors affecting onset and progression of the following 14 priority neurological conditions: Alzheimer's disease (AD), amyotrophic lateral sclerosis (ALS), brain tumours (BT), cerebral palsy (CP), dystonia, epilepsy, Huntington's disease (HD), hydrocephalus, multiple sclerosis (MS), muscular dystrophies (MD), neurotrauma, Parkinson's disease (PD), spina bifida (SB), and Tourette's syndrome (TS). The burden of neurological disease is expected to increase as the population ages, and this trend is presented in greater detail for Alzheimer's and Parkinson's disease because the incidence of these two common neurological diseases increases significantly with age over 65 years. This article provides an overview of burden of neurological diseases in Canada to set the stage for the in-depth systematic reviews of the 14 priority neurological conditions presented in subsequent articles in this issue.

[PMID: 27153747](#)