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## Interventions and Management

**1. Neurologia. 2015 Aug 20. pii: S0213-4853(15)00151-6. doi: 10.1016/j.nrl.2015.05.008. [Epub ahead of print]**

**Childhood cerebral palsy and the use of positioning systems to control body posture: Current practices.**

Pérez-de la Cruz S.

**INTRODUCTION:** One of the consequences of poor postural control in children with cerebral palsy is hip dislocation. This is due to the lack of weight-bearing in the sitting and standing positions. Orthotic aids can be used to prevent onset and/or progression. **OBJECTIVE:** The aim of this study is to analyse the effectiveness of positioning systems in achieving postural control in patients with cerebral palsy, and discuss these findings with an emphasis on what may be of interest in the field of neurology. **DISCUSSION:** We selected a total of 18 articles on interventions in cerebral palsy addressing posture and maintenance of ideal postures to prevent deformities and related problems. The main therapeutic approaches employed combinations of botulinum toxin and orthoses, which reduced the incidence of hip dislocation although these results were not significant. On the other hand, using positioning systems in 3 different positions decreases use of botulinum toxin and surgery in children under 5 years old. The drawback is that these systems are very uncomfortable. **CONCLUSION:** Postural control systems helps control hip deformities in children with cerebral palsy. However, these systems must be used for prolonged periods of time before their effects can be observed.

[PMID: 26300497](#)

**2. Res Dev Disabil. 2015 Aug 27;45-46:343-352. doi: 10.1016/j.ridd.2015.08.007. [Epub ahead of print]**

**Translation and construct validity of the Trunk Control Measurement Scale in children and youths with brain lesions.**

Mitteregger E, Marsico P, Balzer J, van Hedel HJ.

Trunk control is essential for the performance of everyday tasks. Children with neurological impairments such as cerebral palsy (CP) or acquired brain injury (ABI) commonly show impaired trunk control, which leads to restriction in functional activities. The aim of this study was to provide construct validity of the German version of the Trunk Control Measurement Scale (TCMS). We investigated convergent and discriminant construct validity by comparing the TCMS with the Gross Motor Function Classification System (GMFCS) and the modified Timed up and Go (mTUG). Several TCMS items were validated with force plate measurements. The centre of pressure (COP) parameters included the standard deviation of amplitude, the COP displacement and the area. Fifty-two children with CP and ten children with ABI (mean age 10.9 years 4.9 months, range 5-18 years, GMFCS levels I-IV) participated. Spearman rank correlation coefficients calculated between the TCMS and the GMFCS and mTUG amounted to -0.75 and -0.42, respectively. Validating TCMS items with COP parameters was difficult. Nevertheless, the results support the validity of the TCMS in children with brain lesions. This study provides paediatric

therapists working in German speaking countries with a valid tool to assess impaired trunk control in these children. Although originally designed for children with CP, our results show that the TCMS may also be applicable to children with ABI, but more research is needed on a larger population.

[PMID: 26298042](#)

**3. BMJ Open. 2015 Jun 26;5(6):e008059. doi: 10.1136/bmjopen-2015-008059.**

**FAST CP: protocol of a randomised controlled trial of the efficacy of a 12-week combined Functional Anaerobic and Strength Training programme on muscle properties and mechanical gait deficiencies in adolescents and young adults with spastic-type cerebral palsy.**

Gillett JG, Lichtwark GA, Boyd RN, Barber LA.

**INTRODUCTION:** Individuals with cerebral palsy (CP) have muscles that are smaller, weaker and more resistant to stretch compared to typically developing people. Progressive resistance training leads to increases in muscle size and strength. In CP, the benefits of resistance training alone may not transfer to improve other activities such as walking; however, the transfer of strength improvements to improved mobility may be enhanced by performing training that involves specific functional tasks or motor skills. This study aims to determine the efficacy of combined functional anaerobic and strength training in (1) influencing muscle strength, structure and function and (2) to determine if any changes in muscle strength and structure following training impact on walking ability and gross motor functional capacity and performance in the short (following 3 months of training) and medium terms (a further 3 months post-training). **METHODS AND ANALYSIS:** 40 adolescents and young adults with CP will be recruited to undertake a 12-week training programme. The training programme will consist of 3 × 75 min sessions per week, made up of 5 lower limb resistance exercises and 2-3 functional anaerobic exercises per session. The calf muscles will be specifically targeted, as they are the most commonly impacted muscles in CP and are a key muscle group involved in walking. If, as we believe, muscle properties change following combined strength and functional training, there may be long-term benefits of this type of training in slowing the deterioration of muscle function in people with spastic-type CP. **ETHICS AND DISSEMINATION:**

Ethical approval has been obtained from the ethics committees at The University of Queensland (2014000066) and Children's Health Queensland (HREC/15/QRCH/30). The findings will be disseminated by publications in peer-reviewed journals, conferences and local research organisations' media. **TRIAL REGISTRATION NUMBER:** Australian and New Zealand Clinical Trials Registry (ACTRN12614001217695).

[PMID: 26116614](#)

**4. J Phys Ther Sci. 2015 Jul;27(7):2299-301. doi: 10.1589/jpts.27.2299. Epub 2015 Jul 22.**

**Comparison of center-of-pressure displacement during sit-to-stand according to chair height in children with cerebral palsy.**

Lee HY, Lee IH.

[Purpose] In patients with cerebral palsy (CP), performance of the sit-to-stand (STS) task is influenced by an asymmetrical motor pattern. The purpose of this study was to analyze the effects of an elevated chair on STS performance in patients with CP. [Subjects and Methods] Nine CP patients performed STS from a height-adjustable instrumented chair at their natural speed, with the ankle at a 90° angle to the floor. The center-of-pressure (COP) displacement was recorded under the feet. Each foot position was tested at two chair heights corresponding to 100% and 120% of the leg length. The extent and speed of COP were calculated. [Results] The anteroposterior speed and extent of COP were greater with the standard chair than with the elevated chair. The other parameters such as mediolateral speed, extent, and vertical speed of the COP were not different between the two chairs. [Conclusion] These findings suggest that the sway with STS performed from the elevated chair was lesser than that with STS performed from the standard chair. This information will be relevant to clinicians involved in the rehabilitation of CP patients and will help identify factors that influence STS performance.

[PMID: 26311970](#)

**5. Dev Med Child Neurol. 2015 Aug 24. doi: 10.1111/dmcn.12872. [Epub ahead of print]**

**Differences in health-related quality of life and caregiver burden after hip and spine surgery in non-ambulatory children with severe cerebral palsy.**

Difazio RL, Vessey JA, Zurakowski D, Snyder BD.

AIM: The aim of this study was to evaluate changes in caregivers' perceptions of health-related quality of life (HRQOL) and caregiver impact in children with severe, non-ambulatory cerebral palsy after orthopedic surgery to correct hip or spine deformities. METHOD: A prospective longitudinal cohort study (n=44) design was used to measure changes before and after surgery. Caregivers completed the Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD) and the Assessment of Caregiver Experience with Neuromuscular Disease (ACEND). Data collection was between February 2011 and February 2014. Caregivers were included if their child was 3 to 25 years old, had cerebral palsy in Gross Motor Function Classification System levels IV and V, and was scheduled for orthopedic surgery. Analysis of variance with repeated measures was used to assess changes before and at four time points after surgery. RESULTS: Forty-four caregivers participated. Caregivers' perceptions of their child's HRQOL demonstrated an improvement from baseline to 12 months (p<0.001). Patients who had spine surgery demonstrated a steady improvement over time, whereas patients who had hip surgery had a decrease at 6 weeks followed by steady improvement. Improvements were noted in five of six of the CPOCHILD domains, with no changes in the quality of life domain. No changes were noted in any of the ACEND domains. INTERPRETATION: Caregivers report an improvement in a variety of domains of HRQOL 1 year after orthopedic surgery.

[PMID: 26299261](#)

**6. Arch Phys Med Rehabil. 2015 Aug 21. pii: S0003-9993(15)01077-1. doi: 10.1016/j.apmr.2015.08.411. [Epub ahead of print]**

**A Cross-Sectional Study of Bowel Symptoms in Adults with Cerebral Palsy: Prevalence and Impact on Quality of Life.**

Marciniak CM, Lee J, Jesselson M, Gaebler-Spira D.

OBJECTIVE: To determine the prevalence and type of bowel symptoms, and their impact on health-related quality of life (HQOL) in adults with cerebral palsy (CP) DESIGN: Prospective, cross-sectional study SETTING: Urban, outpatient rehabilitation facility PARTICIPANTS: Adults with CP INTERVENTION: Not applicable. MAIN OUTCOME MEASURES: Participants were interviewed using standardized instruments to assess the frequency and types of bowel dysfunction. The International Consultation of Incontinence Questionnaire-Bowel was used to assess bowel incontinence and impact on QOL and constipation presence was determined using the Rome III Criteria for Constipation. Constipation symptoms were rated by the Patient Assessment of Constipation-Symptom Scale. Participants' mobility status was classified using the Gross Motor Functional Classification Scale (GMFCS). Interactions between mobility measures, anthropometric measures and bowel symptoms were assessed. RESULTS: 46 males and 45 women (mean age 36, range 18-79 years) were enrolled. 62.6% of these individuals were GMFCS IV-V. 30.9% reported severe difficulty with control of liquid stool (rating never or rarely); these participants were more likely to have a greater GMFCS level (P=0.0004). 28.6% reported bowel function caused embarrassment some/most/all of the time. 64.8% met criteria for chronic constipation, which did not differ by GMFCS levels. Overall, 57.1% reported bowels interfered with life; 40.7% reported moderate to severe interference. CONCLUSIONS: Bowel symptoms were frequent, a source of embarrassment, and impacted HQOL in these adults with CP. Addressing bowel-related symptoms has the potential to improve HQOL in these adults.

[PMID: 26301386](#)

**7. J Phys Ther Sci. 2015 Jul;27(7):2151-4. doi: 10.1589/jpts.27.2151. Epub 2015 Jul 22.**

**Effects of conventional neurological treatment and a virtual reality training program on eye-hand coordination in children with cerebral palsy.**

Shin JW, Song GB, Hwangbo G.

[Purpose] The purpose of the study was to evaluate the effects of conventional neurological treatment and a virtual reality

training program on eye-hand coordination in children with cerebral palsy. [Subjects] Sixteen children (9 males, 7 females) with spastic diplegic cerebral palsy were recruited and randomly assigned to the conventional neurological physical therapy group (CG) and virtual reality training group (VRG). [Methods] Eight children in the control group performed 45 minutes of therapeutic exercise twice a week for eight weeks. In the experimental group, the other eight children performed 30 minutes of therapeutic exercise and 15 minutes of a training program using virtual reality twice a week during the experimental period. [Results] After eight weeks of the training program, there were significant differences in eye-hand coordination and visual motor speed in the comparison of the virtual reality training group with the conventional neurological physical therapy group. [Conclusion] We conclude that a well-designed training program using virtual reality can improve eye-hand coordination in children with cerebral palsy.

[PMID: 26311943](#)

**8. Dev Med Child Neurol. 2015 Aug 25. doi: 10.1111/dmcn.12879. [Epub ahead of print]**

**Not there yet: the classification of communication in cerebral palsy.**

This commentary is on the original article by Virella et al.

Potter NL.

[PMID: 26303296](#)

**9. Dev Med Child Neurol. 2015 Aug 25. doi: 10.1111/dmcn.12876. [Epub ahead of print]**

**Use of the Hammersmith Infant Neurological Examination in infants with cerebral palsy: a critical review of the literature.**

Romeo DM, Ricci D, Brogna C, Mercuri E.

The Hammersmith Infant Neurological Examination (HINE) has been proposed as one of the early neurological examination tools for the diagnosis of cerebral palsy (CP). The aim of the present study was to critically review the existing literature and our experience with the use of the HINE in infants at risk of CP. The published papers confirm that the HINE can play an important role in the diagnosis and prognosis of infants at risk of developing CP, and provide information on aspects of neurological findings impaired in different forms of CP and brain lesions.

[PMID: 26306473](#)

**10. Res Dev Disabil. 2015 Aug 20;45-46:353-364. doi: 10.1016/j.ridd.2015.08.008. [Epub ahead of print]**

**The influence of errors during practice on motor learning in young individuals with cerebral palsy.**

van Abswoude F, Santos-Vieira B, van der Kamp J, Steenbergen B.

The aim of this study was to investigate the effect of errors during practice on motor skill learning in young individuals with cerebral palsy (CP). Minimizing errors has been validated in typically developing children and children with intellectual disabilities as a method for implicit learning, because it reduces working memory involvement during learning. The present study assessed whether a practice protocol that aims at minimizing errors can induce implicit learning in young individuals with CP as well. Accordingly, we hypothesized that reducing errors during practice would lead to enhanced learning and a decrease in the dependency of performance on working memory. Young individuals with CP practiced an aiming task following either an error-minimizing (N=20) or an error-strewn (N=18) practice protocol. Aiming accuracy was assessed in pre-, post- and retention test. Dual task performance was assessed to establish dependency on working memory. The two practice protocols did not invoke different amounts or types of learning in the participants with CP. Yet, participants improved aiming accuracy and showed stable motor performance after learning, irrespective of the protocol they followed. Across groups the number of errors made during practice was related to the amount of learning, and the degree of conscious monitoring of the

movement. Only participants with relatively good working memory capacity and a poor initial performance showed a rudimentary form of (most likely, explicit) learning. These new findings on the effect of the amount of practice errors on motor learning in children of CP are important for designing interventions for children and adolescents with CP.

[PMID: 26299638](#)

## Prevention and Cure

**11. Arch Dis Child Fetal Neonatal Ed. 2015 Aug 24. pii: fetalneonatal-2014-307820. doi: 10.1136/archdischild-2014-307820. [Epub ahead of print]**

**Neurodevelopmental outcome in very low birthweight infants with pathological umbilical artery flow.**

Brütsch S, Burkhardt T, Kurmanavicius J, Bassler D, Zimmermann R, Natalucci G, Ochsenbein-Kölbl N.

**OBJECTIVE:** To assess neurodevelopmental outcome during toddlerhood in very low birthweight (VLBW) infants with absent or reverse end-diastolic flow (AREDF) in the umbilical artery (UA) during pregnancy. **DESIGN:** Retrospective cohort study with matched control group. **SETTING:** Tertiary perinatal centre. **PATIENTS AND OUTCOME MEASURES:** We compared longitudinally collected data on neonatal and neurodevelopmental outcomes among 41 infants born in our institution from 1997 to 2010 with birth weight <1500 g and UA AREDF and 41 infants with prenatally normal UA Doppler parameters matched for gestational age, birth weight, sex and year of birth. We evaluated neurodevelopmental outcome at a median (range) corrected age of 23.3 (10.1-29.6) months using the Bayley scales of infant development, 2nd edition (BSID-II), and neurological examination. **RESULTS:** The mental development index in UA AREDF children (median (range) 84 (49-116)) was significantly lower than in controls (median (range) 91 (62-140)), including after adjustment for confounders. Intergroup differences in psychomotor development index (PDI; BSID-II) and the rate of cerebral palsy or minor neuromotor dysfunction were non-significant. **CONCLUSIONS:** VLBW infants with UA AREDF have a higher risk of poorer mental development during toddlerhood than controls matched for gestational age, birth weight, sex and year of birth. UA AREDF may be considered a prenatal predictor of poorer mental development in this population. Long-term follow-up studies with larger cohorts are needed to better evaluate the impact of this prenatal factor on later neurodevelopment.

[PMID: 26304460](#)

**12. Biochem Pharmacol. 2015 Aug 20. pii: S0006-2952(15)00538-9. doi: 10.1016/j.bcp.2015.08.093. [Epub ahead of print]**

**Role of sex steroids and their receptors in human preterm infants: Impacts on future treatment strategies for cerebral development.**

Hübner S, Reich B, Heckmann M.

Preterm birth is a major risk factor for cerebral complications, such as hemorrhage or periventricular leukomalacia, which lead to lifelong neurodevelopmental deficits. Hypoxia/ischemia, inflammation, hyperoxia, and prematurity itself contribute to the extent of impaired neurodevelopment. Preterm birth leads to disruption of the placental supply of estrogens and progesterone. Postnatally, the plasma levels of estrogens and progesterone drop 100-fold. Preterm infants are deprived of the placental supply of these hormones for up to sixteen weeks. Thus, supplementation of estradiol and progesterone to mimic intrauterine conditions may potentially improve a premature infant's extrauterine development and help protect the brain against neurological complications. However, preliminary clinical studies did not find improved outcomes except for a trend towards less cerebral palsy. The decrease in estrogen and progesterone concentrations is accompanied by persistent, high postnatal production of fetal zone steroids, mainly dehydroepiandrosterone, which serve as precursors for maternal estrogen synthesis during pregnancy. This commentary will combine knowledge from endocrinology, pharmacology, and neonatology to explain the discrepancies between promising animal models and clinical findings. Most important targets will be classical and non-classical estrogen receptors, which interact differently-not only with estrogens but also with fetal zone steroids. The fetal zone is unique among humans and higher primates. Therefore, a clearly defined model is required to study the role of sex steroids and their receptors before further clinical studies begin.

[PMID: 26300058](#)

13. *BMC Pediatr.* 2015 Aug 26;15(1):100. doi: 10.1186/s12887-015-0411-y.

**The ProVIDe study: the impact of protein intravenous nutrition on development in extremely low birthweight babies.**

Bloomfield FH, Crowther CA, Harding JE, Conlon CA, Jiang Y, Cormack BE

**BACKGROUND:** Preterm birth and very small size at birth have long-term effects on neurodevelopment and growth. A relatively small percentage of extremely low birthweight babies suffer from severe neurological disability; however, up to 50 % experience some neurodevelopmental or learning disability in childhood. Current international consensus is that increased protein intake in the neonatal period improves both neurodevelopment and growth, but the quantum of protein required is not known. This trial aims to assess whether providing an extra 1 to 2 g.kg<sup>(-1)</sup>.d<sup>(-1)</sup> protein in the first 5 days after birth will improve neurodevelopmental outcomes and growth in extremely low birthweight babies. **METHODS/DESIGN:** The ProVIDe study is a multicentre, two-arm, double-blind, parallel, randomised, controlled trial. In addition to standard intravenous nutrition, 430 babies with a birthweight of less than 1000 g who have an umbilical arterial line in situ will be randomised in 1:1 ratio to receive either an amino acid solution (TrophAmine®) or placebo (saline) administered through the umbilical arterial catheter for the first 5 days. Exclusion criteria are admission to neonatal intensive care more than 24 h after birth; multiple births of more than 2 babies; known chromosomal or genetic abnormality, or congenital disorder affecting growth; inborn error of metabolism, and in danger of imminent death. **PRIMARY OUTCOME:** Survival free from neurodevelopmental disability at 2 years' corrected age, where neurodevelopmental disability is defined as cerebral palsy, blindness, deafness, developmental delay (standardised score more than 1 SD below the mean on the cognitive, language or motor subscales of the Bayley Scales of Infant Development Edition 3), or Gross Motor Function Classification System score  $\geq 1$ . **SECONDARY OUTCOMES:** Growth, from birth to 36 weeks' corrected gestational age, at neonatal intensive care discharge and at 2 years' corrected age; body composition at 36 to 42 weeks' corrected postmenstrual age and at 2 years' corrected age; neonatal morbidity, including length of stay; nutritional intake. **DISCUSSION:** This trial will provide the first direct evidence of the effects of giving preterm babies a higher intake of intravenous protein in the first week after birth on neurodevelopmental outcomes at 2 years corrected age. **TRIAL REGISTRATION:** Australian New Zealand Clinical Trials Registry: ACTRN12612001084875

[PMID: 26307566](#)