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Interventions and Management

1. *Pediatr Phys Ther.* 2013 Aug 22. [Epub ahead of print]

Anaerobic Performance in Children With Cerebral Palsy Compared to Children With Typical Development.

Verschuren O, Maltais DB, Douma-van Riet D, Kruitwagen C, Ketelaar M.

Brain Center Rudolf Magnus and Center of Excellence for Rehabilitation Medicine (Drs Verschuren and Ketelaar), University Medical Center Utrecht and De Hoogstraat Rehabilitation, Utrecht, the Netherlands; Partner of NetChild (Drs Verschuren and Ketelaar), Network for Childhood Disability Research, Utrecht, the Netherlands; Department of Rehabilitation (Dr Maltais), Laval University, Quebec City, Quebec, Canada; Practice for Pediatric Physical Therapy (Ms Douma-van Reit), Zuidwest Koudum, the Netherlands; Julius Centre for Health Sciences and Primary Care (Ms Kruitwagen), Utrecht, the Netherlands.

PURPOSE: Using a locomotor-based field test of anaerobic performance, this study compared the anaerobic performance of children with spastic cerebral palsy (CP) who walk without support with that of peers who are typically developing. **METHODS:** The Muscle Power Sprint Test was performed by 159 children with CP (102 boys, mean age 9.7 ± 1.5 years; and 57 girls, mean age 9.5 ± 1.6 years) classified at Gross Motor Function Classification System level I ($n = 115$) or level II ($n = 44$) and 376 children with typical development (175 boys, mean age 8.9 ± 1.8 years; and 201 girls, mean age 9.0 ± 1.7 years). **RESULTS:** The anaerobic performance of the children with CP was lower than that of peers with typical development. **CONCLUSIONS:** The difference between the 2 groups increased with height, especially for the children with CP classified at Gross Motor Function Classification System level II. Children with CP appear to have impaired anaerobic performance.

[PMID: 23974826](https://pubmed.ncbi.nlm.nih.gov/23974826/) [PubMed - as supplied by publisher]

2. *Pediatr Phys Ther.* 2013 Aug 22. [Epub ahead of print]

Commentary on "Anaerobic Performance in Children With Cerebral Palsy Compared to Children With Typical Development"

Wong J, Knight S.

Children's Hospital Los Angeles Los Angeles, California.

[PMID: 23974827](https://pubmed.ncbi.nlm.nih.gov/23974827/) [PubMed - as supplied by publisher]

3. Surgery. 2013 Sep;154(3):479-85. doi: 10.1016/j.surg.2013.05.038.**Increased complications after appendectomy in patients with cerebral palsy: Are special needs patients at risk for disparities in outcomes?**

Dhiman N, Chi A, Pawlik TM, Efron DT, Haut ER, Schneider EB, Hashmi ZG, Scott VK, Hui X, Ali MT, Haider AH.

Center for Surgical Trials and Outcomes Research, The Johns Hopkins School of Medicine, Baltimore, MD.

BACKGROUND: Cerebral palsy (CP) is a nonprogressive neurologic disorder. Anecdotal evidence suggests there are worse outcomes in this population after common operative procedures like appendectomy. This study aims to classify whether there are relevant disparities in postoperative outcomes in CP versus non-CP patients after open or laparoscopic appendectomy. **METHODS:** Hospital discharge data from the 2003-2009 weighted Nationwide Inpatient Sample were used. Unadjusted and adjusted multiple logistic regression were used to assess postoperative complications, as well as inpatient mortality, average duration of hospital stay, and cost. **RESULTS:** Approximately 1,250 patients with CP met the inclusion criteria. After adjusted analysis, CP patients displayed significantly greater odds of the following postoperative complications: Sepsis/organ failure, operation-related infection, pneumonia, urinary tract infection, and acute respiratory distress syndrome. Patients with CP also had a greater cost and in-hospital stay after appendectomy. **CONCLUSION:** Patients with CP have greater adjusted odds of complications after open or laparoscopic appendectomy. The mechanisms that led to these disparities need to be studied and may include difficulties in patient assessment and communication. Additional education of healthcare providers to improve recognition of symptoms and care for patients with disabilities may be more immediately helpful in decreasing disparities in outcomes.

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4. J Intellect Dev Disabil. 2013 Sep;38(3):274-5. doi: 10.3109/13668250.2013.798894.**Cerebral Palsy: From Diagnosis to Adult Life.**

Hemsley B.

The University of Newcastle , Australia.

[PMID: 23984886](#) [PubMed - in process]

5. PM R. 2013 Aug 23. pii: S1934-1482(13)01018-6. doi: 10.1016/j.pmrj.2013.07.012. [Epub ahead of print]**Urinary Incontinence in Adults with Cerebral Palsy: Prevalence, Type, and Effects on Participation.**

Marciniak Christina M, O'Shea Sarah A, Lee J, Jesselson M, Dudas-Sheehan D, Beltran Erik J, Gaebler-Spira Deborah J.

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OBJECTIVE: To assess the prevalence, type, and impact of urinary problems in adults with cerebral palsy (CP) and their relationship with Gross Motor Functional Classification Scale (GMFCS). **DESIGN:** Cross-Sectional Prospective Survey Study **SETTING:** Outpatient, Urban, Academic Rehabilitation Clinic **PARTICIPANTS:** 91 adults with cerebral palsy (45 women and 46 men) **INTERVENTIONS:** Subjects were approached at clinic presentation and interviewed regarding current function, type and incidence of bladder issues, and concerns with bladder problems. **MAIN OUTCOME MEASURES:** International Consultation on Incontinence Questionnaire-Female or - Male Lower Urinary Tract Symptoms Module, GMFCS, employment and type of residence. **RESULTS:** Mean age for both females and males was 36 years (range 18 - 79). Subjects were currently GMFCS I to V: I - 4.4 percent (%), II-19.8%, III-13.2%, IV-40.7%, and V-22.0%. 95.6% of females and 84.7% of males were living at home. Twenty-three percent were currently employed. Twenty percent of women indicated they had bladder urgency most to all of the time and 46.7%

of females had leakage occurring 2-3 times per week to several times per day. In males, urgency occurring more often than "occasionally" was reported by 45.7 %, and 19.6 % reported this occurred "most to all of the time". Multivariable analyses found obese compared to normal weight was significantly related to leaking before reaching toilet (OR=4.3, CI: 1.3, 14.7), to leaking with cough, exercise or sneeze (OR=5.6, CI: 1.3, 23.1), and to nocturia (OR=5.4, CI: 1.2, 25.1). Females were more likely to leak with cough, exercise or sneeze (OR=5.5, CI: 1.5, 20.0). On scales indicating symptom interference with life, high levels of interference were reported for females with symptoms of leaking, and males with urgency and leaking. No significant differences in living situation or employment were related to incontinence scores for females or males. **CONCLUSIONS:** There are high levels of incontinence in adults with CP, and they report interference with quality of life. Despite these issues, most participants were living in the community and incontinence scores were not related to employment.

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6. AJNR Am J Neuroradiol. 2013 Aug 29. [Epub ahead of print]

Brain MRI Measurements at a Term-Equivalent Age and Their Relationship to Neurodevelopmental Outcomes.

Park HW, Yoon HK, Han SB, Lee BS, Sung IY, Kim KS, Kim EA.

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BACKGROUND AND PURPOSE:An increased prevalence of disabilities is being observed as more preterm infants survive. This study was conducted to evaluate correlations between brain MR imaging measurements taken at a term-equivalent age and neurodevelopmental outcome at 2 years' corrected age among very low-birth-weight infants. **MATERIALS AND METHODS:** Of the various brain MR imaging measurements obtained at term-equivalent ages, reproducible measurements of the transcerebellar diameter and anteroposterior length of the corpus callosum on sagittal images were compared with neurodevelopmental outcomes evaluated by the Bayley Scales of Infant Development (II) at 2 years' corrected age (mean \pm standard deviation, 16.1 \pm 6.4 months of age). **RESULTS:** Ninety infants were enrolled. The mean gestational age at birth was 27 weeks and the mean birth weight was 805.5 g. A short corpus callosal length was associated with a Mental Developmental Index <70 ($P = .047$) and high-risk or diagnosed cerebral palsy ($P = .049$). A small transcerebellar diameter was associated with a Psychomotor Developmental Index <70 ($P = .003$), Mental Developmental Index <70 ($P = .004$), and major neurologic disability ($P = .006$). **CONCLUSIONS:**A small transcerebellar diameter and short corpus callosal length on brain MR imaging at a term-equivalent age are related to adverse neurodevelopmental outcomes at a corrected age of 2 years and could be a useful adjunctive tool for counseling parents about future developmental outcomes.

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7. Dev Neurorehabil. 2013 Aug 26. [Epub ahead of print]

Comparison of effects of lower extremity orthoses on energy expenditure in patients with cerebral palsy.

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Objective: The aim of the study was to compare the effects of lower extremity orthoses on energy expenditure in patients with cerebral palsy (CP). **Methods:** We included 48 children with CP using lower extremity orthosis. Energy expenditures determined based on heart rate, yielded an energy expenditure index (EEI) with and without orthosis during walking. Results were compared statistically between orthosis groups (solid polyethylene ankle foot orthosis (PAFO), articulated PAFO, ground reaction foot orthosis (GRAFO), plastic and metallic knee-ankle-foot-orthosis

(KAFO), and metallic AFO). Results: It was found that an advancement in energy expenditure was seen with plastic orthoses which is more prominent by solid PAFO ($p = 0.008$). Conclusion: It was concluded that especially solid PAFO can be more beneficial in terms of energy consumption in CP patients. In rehabilitation phase, the EEI measurement was seen to be a useful and practical method for choosing the proper orthosis type.

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Prevention and Cure

8. Dev Neurosci. 2013 Aug 27. [Epub ahead of print]

Maternal Endotoxin Exposure Results in Abnormal Neuronal Architecture in the Newborn Rabbit.

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Maternal intrauterine inflammation/infection is a potential risk factor for the development of neurologic disorders such as cerebral palsy (CP) in preterm and term infants. CP is associated with white matter and grey matter injury. In the current study, we used a rabbit model of CP in which pregnant rabbits are administered intrauterine injections of the endotoxin lipopolysaccharide. We then investigated the extent of neuronal damage in the newborn kit brain. We observed an overall decrease in the number of MAP2-stained neurons and an increase in Fluoro-Jade C-stained cells in the anterior thalamus of 1-day-old rabbit brain. We also observed an overall decrease in the number of branching points and spine density in the retrosplenial cortex, a major output region of the anterior thalamus that is involved in cognition and memory. The loss of spines and dendritic atrophy in the retrosplenial cortex may be caused by loss of presynaptic input from the thalamus. Our study indicates that the cognitive impairments seen in patients with CP may be related to the degeneration of neurons and abnormal arborization of the thalamic and cortical neurons. © 2013 S. Karger AG, Basel.

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9. Gynecol Obstet Fertil. 2013 Aug 26. pii: S1297-9589(13)00203-8. doi: 10.1016/j.gyobfe.2013.07.020. [Epub ahead of print]

Diagnosis of neonatal metabolic acidosis by eucapnic pH determination [Article in French]

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The identification of a metabolic acidosis is a key criterion for establishing a causal relationship between fetal perpartum asphyxia and neonatal encephalopathy and/or cerebral palsy. The diagnostic criteria currently used (pH and base deficit or lactatemia) are imprecise and non-specific. OBJECTIVE: The study aimed to determine among a low-risk cohort of infants born at term ($n=867$), the best diagnostic tool of metabolic acidosis in the cordal from the following parameters: pH, blood gases and lactate values at birth. MATERIALS AND METHODS: The data were obtained from arterial blood of the umbilical cord by a blood gas analyser. The parameter best predicting metabolic analysis was estimated from the partial correlations established between the most relevant parameters. RESULTS: The results showed a slight change in all parameters compared to adult values: acidemia (pH: 7.28 ± 0.01), hypercapnia (56.5 ± 1.59 mmHg) and hyperlactatemia (3.4 ± 0.05 mmol/L). From partial correlation analysis, pCO_2 emerged to be the main contributor of acidemia, while lactatemia was shown to be non-specific for metabolic acidosis. Seven cases (0.81 %) showed a pH less than 7.00 with marked hypercapnia. The correction of this respiratory component by EISENBERG's method led to the eucapnic pH, classifying six out of seven cases as exclusive respiratory acidosis. DISCUSSION AND CONCLUSION: It has been demonstrated that the criteria from ACOG-AAP for defining a metabolic acidosis are incomplete, imprecise and generating errors in excess. The same is true for lactatemia, whose physiological significance has been completely revised, challenging the misconception

of lactic acidosis as a specific marker of hypoxia. It appeared that eucapnic pH was the best way for obtaining a reliable diagnosis of metabolic acidosis. We proposed to adopt a simple decision scheme for determining whether a metabolic acidosis has occurred in case of acidemia less than 7.00.

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10. J Pediatr. 2013 Sep;163(3):828-834.e1. doi: 10.1016/j.jpeds.2013.03.014. Epub 2013 Apr 13.

Clinical, biochemical, and neuroimaging findings predict long-term neurodevelopmental outcome in symptomatic congenital cytomegalovirus infection.

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OBJECTIVE: To evaluate clinical, biochemical, and neuroimaging findings as predictors of neurodevelopmental outcome in patients with symptomatic congenital cytomegalovirus (CMV). **STUDY DESIGN:** The study cohort comprised 26 patients with symptomatic congenital CMV born between 1993 and 2009 in a single center. Absolute and weight deficit-adjusted head circumference were considered. Cerebrospinal fluid (CSF) investigations included standard cytochemical analysis, determination of beta2-microglobulin (β 2-m), neuron-specific enolase, and CMV DNA detection. Neuroimaging was classified according to a validated scoring system comprising calcifications, ventriculomegaly, and atrophy, with findings graded from 0 to 3. Systematic long-term neurodevelopmental assessment included motor function, cognition, behavior, hearing, vision, and epilepsy. Sequelae were graded as mild/absent, moderate, or severe; adverse outcome was defined as death or moderate to severe disability. **RESULTS:** Three children died. The mean age at follow-up of the survivors was 8.7 ± 5.3 years (range, 19 months to 18.0 years). Neonatal findings showing a significant association with adverse outcome were relative microcephaly, CSF β 2-m concentrations, and grade 2-3 neuroimaging abnormalities ($P < .05$). Receiver operator characteristic curve analysis indicated that the most accurate single factor for predicting unfavorable outcome was CSF β 2-m >7.9 mg/L (area under the curve, 0.84 ± 0.08 ; sensitivity, 69%; specificity, 100%). The combination of CSF β 2-m >7.9 mg/L and moderate-severe neuroimaging alterations improved predictive ability (area under the curve, 0.92 ± 0.06 ; sensitivity, 87%; specificity, 100%). **CONCLUSION:** Adjusted head circumference, CSF β 2-m level, and neuroimaging studies have prognostic significance for neurodevelopmental outcome in newborns with congenital CMV. A combination of early findings improves the predictive value.

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11. Med J Aust. 2013 Aug 19;199(4):288-99.

Research using autologous cord blood - time for a policy change.

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Type 1 diabetes results from the loss of normal immunological self-tolerance, which may be attributable to the failure of Foxp3+ regulatory T cells (Tregs). Umbilical cord blood is rich in Tregs and therefore has the potential to prevent or delay the onset of type 1 diabetes. A pilot trial is currently underway in Australia to examine whether infusion of autologous cord blood can prevent type 1 diabetes in high-risk children with serum antibodies to multiple β -cell antigens. A number of other potential therapeutic indications for autologous cord blood have been proposed, including cerebral palsy and hypoxic-ischaemic encephalopathy. Recruitment to clinical trials using cord blood is influenced by divergent public and private cord blood banking policy in Australia. The burgeoning consumer demand for storage of cord blood highlights the need for regulatory bodies to develop and adapt policies to facilitate

research that may extend the use of cord blood beyond currently recognised indications. Consumers, researchers and policymakers must also recognise specific ethical issues associated with collection and storage of cord blood, including storage in public and private banks, informed consent, ownership, access and the principle of beneficence.

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12. PLoS One. 2013 Aug 16;8(8):e70288. doi: 10.1371/journal.pone.0070288.

Disruption of Basal lamina components in neuromotor synapses of children with spastic quadriplegic cerebral palsy.

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Cerebral palsy (CP) is a static encephalopathy occurring when a lesion to the developing brain results in disordered movement and posture. Patients present with sometimes overlapping spastic, athetoid/dyskinetic, and ataxic symptoms. Spastic CP, which is characterized by stiff muscles, weakness, and poor motor control, accounts for ~80% of cases. The detailed mechanisms leading to disordered movement in spastic CP are not completely understood, but clinical experience and recent studies suggest involvement of peripheral motor synapses. For example, it is recognized that CP patients have altered sensitivities to drugs that target neuromuscular junctions (NMJs), and protein localization studies suggest that NMJ microanatomy is disrupted in CP. Since CP originates during maturation, we hypothesized that NMJ disruption in spastic CP is associated with retention of an immature neuromotor phenotype later in life. Scoliosis patients with spastic CP or idiopathic disease were enrolled in a prospective, partially-blinded study to evaluate NMJ organization and neuromotor maturation. The localization of synaptic acetylcholine esterase (AChE) relative to postsynaptic acetylcholine receptor (AChR), synaptic laminin β 2, and presynaptic vesicle protein 2 (SV2) appeared mismatched in the CP samples; whereas, no significant disruption was found between AChR and SV2. These data suggest that pre- and postsynaptic NMJ components in CP children were appropriately distributed even though AChE and laminin β 2 within the synaptic basal lamina appeared disrupted. Follow up electron microscopy indicated that NMJs from CP patients appeared generally mature and similar to controls with some differences present, including deeper postsynaptic folds and reduced presynaptic mitochondria. Analysis of maturational markers, including myosin, syntrophin, myogenin, and AChR subunit expression, and telomere lengths, all indicated similar levels of motor maturation in the two groups. Thus, NMJ disruption in CP was found to principally involve components of the synaptic basal lamina and subtle ultra-structural modifications but appeared unrelated to neuromotor maturational status.

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