

# Science Infos

## Paralysie Cérébrale



LA FONDATION  
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### Focus

*La revue Developmental Medicine and Child Neurology (DMCN) vient de publier un numéro spécial consacré à l'analyse des données issues des registres de Paralysie Cérébrale en Australie*

#### **Cerebral Palsy in Australia,**

*Submissions from the Australian Cerebral Palsy Register Group.*

*Guest Editor: Christine Cans. Associate Editors: Eve Blair, Catherine Gibson and Sue Reid.*

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*Tous les articles sont en accès libre*

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*Dans l'éditorial de ce numéro Le Pr Christine CANS (Grenoble, France) souligne*

- *L'importance d'une collaboration entre les différents registres de Paralysie Cérébrale. La mise en commun des données recueillies offrirait une amélioration de la puissance d'analyse de ces données, par exemple pour analyser les tendances des taux de prévalence chez les bébés de très petite taille, pour quantifier les risques élevés de PC dans les naissances issues de grossesses multiples ou pour étudier l'association entre des anomalies congénitales spécifiques et la PC.*

- *L'importance de faire preuve d'une certaine prudence lors de la mise en commun des données des différents registres de PC et de leur analyse : pour cela disposer de descriptions communes de la PC, s'assurer que l'harmonisation des points de données est suffisante pour permettre une mise en commun précise, utiliser des outils statistiques adaptés pour les données multi-centriques pour permettre une analyse précise.*

*Il est important que les professionnels de santé, les politiques et les personnes atteintes de PC soient sensibilisés au fait que les registres de PC puissent fournir des bénéfices potentiels à partir d'excellentes sources de données.*

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Spastic Paralysis of the Elbow and Forearm.  
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The Influence of a Constraint and Bimanual Training Program Using a Variety of Modalities, on Upper Extremity Functions and Gait Parameters Among Children with Hemiparetic Cerebral Palsy: A Case Series.  
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The Effects of Nintendo Wii-Fit Video Games on Balance in Children with Mild Cerebral Palsy.  
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### ✚ •Troubles de la vision

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### ✚ •Psychologie – Comportement

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## Qualité de vie et rapport au monde

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### ✚ •Retentissement dans la vie quotidienne

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### ✚ •Activité physique - Sport

Barriers and facilitators to participation in physical activity: The experiences of a group of South African adolescents with cerebral palsy.  
Benefits and Enjoyment of a Swimming Intervention for Youth With Cerebral Palsy: An RCT Study.  
Consensus Planning Toward a Community-Based Approach to Promote Physical Activity in Youth with Cerebral Palsy.  
Exercise and physical activity recommendations for people with cerebral palsy.  
Risk of Injuries in Paralympic Track and Field Differs by Impairment and Event Discipline: A Prospective Cohort Study at the London 2012 Paralympic Games.

### ✚ •Accompagnement

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Family quality of life among families with a child who has a severe neurodevelopmental disability: Impact of family and child socio-demographic factors.

### ✚ •Domotique - Nouvelles technologies

Single-Trial Analysis of Inter-Beat Interval Perturbations Accompanying Single-Switch Scanning: Case Series of Three Children With Severe Spastic Quadriplegic Cerebral Palsy.

# Manifestations et congrès

## Mars 2016

### Journées de la SOFOP

23-25 Mars 2016

Toulouse, France

<http://www.sofop-les-seminaires.org/fr/>

### 44emes entretiens de Médecine Physique et de Réadaptation

23-25 Mars 2016

Montpellier, France

<http://empr.fr/EventPortal/Information/EMPR2016/ACCUEIL.aspx>

## Avril 2016

### 20th European Congress of Physical and Rehabilitation Medicine (ESPRM)

23-28 Avril 2016

Lisbonne, Portugal

<http://www.esprm2016.com/en/>

## Mai 2016

### Congrès SFERHE - Société Francophone d'Etude et de Recherche sur les Handicaps de l'Enfance

Mouvements involontaires de l'enfant

23 - 24 Mai 2016

Bordeaux, France,

<http://www.tmsevents.fr/congres/2016/sferhe/>

## Juin 2016

### International Conference on Cerebral Palsy and Other Childhood-onset Disabilities

#### Joint meeting

5Th International Conference of Cerebral palsy (ICPC°

28th Annual Meeting of the European Academy of Childhood Disability (EACD)

1 st Biennial meeting of the International Alliance of Academies of Childhood Disability (IAACD)

1-4 Juin 2016

Suède, Stockholm

<http://eacd2016.org/>

## Septembre 2016

### 6th International Conference on Clinical Neonatology

22-24 Spetembre 2016

Turin, Italie

<https://www.eiseverywhere.com/ehome/105597/234360/>

## Octobre 2016

### 31ème Congrès de la Société française de Médecine Physique et de réadaptation (SOFMER)

13-15 Octobre 2016

Saint Etienne, France

<http://saint-etienne.sofmer2016.com/>

# Publications scientifiques

## Méthodologie de la recherche

Le profil de veille a été mis en place sur Pubmed avec le mot clé "Cerebral Palsy" pour des publications majoritairement en français ou en anglais, avec abstract.

**Free article** indique le lien vers les articles dont le texte intégral est librement disponible

### Cerebral palsy.

Wimalasundera N, Stevenson VL

*Pract Neurol.* 2016 Feb 2. pii: *practneurol-2015-001184*. doi:10.1136/practneurol-2015-001184. [Epub ahead of print]

Cerebral palsy has always been known as a disorder of movement and posture resulting from a non-progressive injury to the developing brain; however, more recent definitions allow clinicians to appreciate more than just the movement disorder. Accurate classification of cerebral palsy into distribution, motor type and functional level has advanced research. It also facilitates appropriate targeting of interventions to functional level and more accurate prognosis prediction. The prevalence of cerebral palsy remains fairly static at 2-3 per 1000 live births but there have been some changes in trends for specific causal groups. Interventions for cerebral palsy have historically been medical and physically focused, often with limited evidence to support their efficacy. The use of more appropriate outcome measures encompassing quality of life and participation is helping to deliver treatments which are more meaningful for people with cerebral palsy and their carers.

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PMID: 26837375 [PubMed - as supplied by publisher]

## Epidémiologie

### Prévalence- Incidence

#### **An international survey of cerebral palsy registers and surveillance systems.**

Goldsmith S, McIntyre S, Smithers-Sheedy H, Blair E, Cans C, Watson L, Yeargin-Allsopp M; Australian Cerebral Palsy Register Group.

*Dev Med Child Neurol.* 2016 Feb;58 Suppl 2:11-7. doi: 10.1111/dmcn.12999. Epub 2016 Jan 19.

**AIM:** To describe cerebral palsy (CP) surveillance programmes and identify similarities and differences in governance and funding, aims and scope, definition, inclusion/exclusion criteria, ascertainment and data collection, to enhance the potential for research collaboration.

**METHOD:** Representatives from 38 CP surveillance programmes were invited to participate in an online survey and submit their data collection forms. Descriptive statistics were used to summarize information submitted.

**RESULTS:** Twenty-seven surveillance programmes participated (25 functioning registers, two closed owing to lack of funding). Their aims spanned five domains: resource for CP research, surveillance, aetiology/prevention, service planning, and information provision (in descending order of frequency). Published definitions guided decision making for the definition of CP and case eligibility for most programmes. Consent, case identification, and data collection methods varied widely. Ten key data items were collected by all programmes and a further seven by at least 80% of programmes. All programmes reported an interest in research collaboration.

**INTERPRETATION:** Despite variability in methodologies, similarities exist across programmes in terms of their aims, definitions, and data collected. These findings will facilitate harmonization of data and collaborative research efforts, which are so necessary on account of the heterogeneity and relatively low prevalence of CP.

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PMID: 26781543 [PubMed - in process]

### **Comparing risks of cerebral palsy in births between Australian Indigenous and non-Indigenous mothers.**

Blair E, Watson L, O'Kearney E, D'Antoine H, Delacy MJ; Australian Cerebral Palsy Register Group.

*Dev Med Child Neurol.* 2016 Feb;58 Suppl 2:36-42. doi: 10.1111/dmcn.13005. Epub 2016 Jan 19.

AIM: To compare proportions of live births subsequently described as having cerebral palsy (CP), the distributions of associated impairments, and the causes of postneonatal CP between Aboriginal and Torres Strait Islander (Indigenous) and non-Indigenous populations in Australia.

METHOD: Data from statutory birth records and CP registers for the 1996 to 2005 birth cohort in Queensland, Western Australia, and the Northern Territory were stratified by Indigenous status and whether the CP was acquired pre/perinatally or postneonatally. Relative risks associated with Indigenous status were estimated and the distributions of causes of postneonatal CP compared.

RESULTS: Indigenous births had a relative risk of 4.9 (95% confidence interval [CI] 3.0-7.9) for postneonatal CP but only of 1.42 (95% CI 1.2-1.7) for pre/perinatal CP. Almost half of postneonatal CP in Indigenous infants resulted from infection, whereas for non-Indigenous infants the most frequent cause was cerebrovascular accident. The impairments of Indigenous CP and of postneonatally acquired CP tended to be more numerous and more severe.

INTERPRETATION: Indigenous children are at significantly greater risk of CP, particularly postneonatal CP. The predominant cause of postneonatal CP in non-Indigenous children has shifted to cerebrovascular accident over time; however, infections followed by head injury are still the most frequent causes in Indigenous infants.

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PMID: 26781773 [PubMed - in process]

### **Congenital anomalies in cerebral palsy: where to from here?**

McIntyre S, Blair E, Goldsmith S, Badawi N, Gibson C, Scott H, Smithers-Sheedy H; Australian Cerebral Palsy Register Group.

*Dev Med Child Neurol.* 2016 Feb;58 Suppl 2:71-5. doi: 10.1111/dmcn.13015. Epub 2016 Jan 14.

Proportions of cases of cerebral palsy (CP) with congenital anomalies recorded in Australian CP registers range from 15% to 40%. The anomalies seen in CP are extremely variable. We have identified that CP registers often do not have quality data on congenital anomalies, necessitating linkage with congenital anomaly registers. However, a lack of unified processes and definitions in congenital anomaly registers and data collections means that linkages are complex, need to be carefully planned, and limitations acknowledged. Historically in CP research, congenital anomalies have been classified by International Classification of Disease codes, then combined into brain and other major and minor anomalies. Systems have been developed to classify congenital anomalies into aetiologically related groups, but such a classification has yet to be trialled in CP. It is anticipated that primary prevention of a small proportion of cases of CP is possible through the primary prevention of congenital anomalies, especially those due to teratogens. Owing to the anticipated low prevalence of each subgroup, global collaboration will be required to further these lines of enquiry.

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PMID: 2676272 [PubMed - in process]

### **Profile of associated impairments at age 5 years in Australia by cerebral palsy subtype and Gross Motor Function Classification System level for birth years 1996 to 2005.**

Delacy M, Reid SM; Australian cerebral palsy register group.

*Dev Med Child Neurol.* 2016 Feb;58 Suppl 2:50-6. doi: 10.1111/dmcn.13012. Epub 2016 Jan 17.

AIM: To describe the distribution of impairments among persons with cerebral palsy (CP) in a large Australian cohort.

METHOD: Records of persons on the Australian Cerebral Palsy Register (ACPR) (n=3466) born from 1996 to 2005 were reviewed to extract year of birth, sex, CP subtype, Gross Motor Function Classification System (GMFCS) level, and impairments in vision, hearing, speech, intellect, and epilepsy. The distributions of GMFCS levels and CP subtype were plotted, and the proportions of each level of impairment were tabulated and presented as stacked graphs within the GMFCS and CP subtype distributions.

RESULTS: The proportions of persons with CP with each associated impairment increased with increasing GMFCS level. Compared with other spastic CP subtypes, individuals with spastic quadriplegia had higher frequencies of all associated impairments. Other than epilepsy, which was most prevalent in persons with spastic quadriplegia (53%), all impairments were most frequent in non-spastic CP subtypes. Hearing impairment was recorded for 21% of  
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persons with dyskinesia whereas the hypotonic subtype had the highest prevalence of visual impairment (57%), intellectual impairment (90%), and speech impairment (95%).

INTERPRETATION: Distributions of associated impairments across all GMFCS levels and CP subtypes in a large cohort are presented in formats suitable for clinical use and discussion with families.

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PMID: 26777873 [PubMed - in process]

### **Temporal trends in cerebral palsy by impairment severity and birth gestation.**

Reid SM, Meehan E, McIntyre S, Goldsmith S, Badawi N, Reddihough DS; Australian Cerebral Palsy Register Group. *Dev Med Child Neurol.* 2016 Feb;58 Suppl 2:25-35. doi: 10.1111/dmcn.13001. Epub 2016 Jan 13.

AIM: Our aim was to build on previous research indicating that rates of cerebral palsy (CP) in the Australian state of Victoria are declining, and examine whether severity of impairments is also decreasing.

METHOD: Data on individuals with CP were extracted from the Victorian Cerebral Palsy Register for birth years 1983 to 2009. The yearly rates of dichotomized categories for gross motor function, motor laterality, intellectual impairment, and epilepsy per 1000 neonatal survivors and proportions in the CP cohort were tabulated and plotted by birth gestation. Linear regression modelling was used to fit prediction curves; likelihood ratio tests were used to test for differences in trends between impairment severity groups.

RESULTS: Since the mid-1990s, CP rates declined in neonatal survivors of birth at all gestations. Our data suggest that the decreasing CP rates were associated with relatively greater decreases in the rates of Gross Motor Function Classification System levels III to V, bilateral CP, epilepsy, and intellectual impairment (all  $p < 0.005$ ). Some variation was seen between birth gestation groups.

INTERPRETATION: Declines in rates of CP of all levels of severity and complexity from the mid-1990s provides 'real-world' support for the effectiveness of concurrent neuroprotective strategies and continual innovation in perinatal practices.

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PMID: 26762733 [PubMed - in process]

## **✚ Facteurs de risque – Causes**

### **Biological sex and the risk of cerebral palsy in Victoria, Australia.**

Reid SM, Meehan E, Gibson CS, Scott H, Delacy MJ; Australian Cerebral Palsy Register Group. *Dev Med Child Neurol.* 2016 Feb;58 Suppl 2:43-9. doi: 10.1111/dmcn.13021. Epub 2016 Jan 14.

AIM: Males typically outnumber females in cerebral palsy (CP) cohorts. To better understand this 'male disadvantage' and provide insight into causal pathways to CP, this study used 1983 to 2009 Australian CP and population birth cohorts to identify associations and trends with respect to biological sex and CP.

METHOD: Within birth gestation groups, sex ratios were calculated to evaluate any male excess in the CP cohort compared with livebirths, neonatal deaths, neonatal mortality and survival rates, neonatal survivors, and CP rates in survivors. Sex- and gestation-specific trends in neonatal mortality, CP rates, and CP sex ratios were assessed by plotting their annual frequencies and fitting quadratic curves.

RESULTS: Over-representation of males in preterm live births partly explained the male excess in the CP cohort after preterm birth, especially at 28 to 31 weeks. Higher CP rates in male neonatal survivors also contributed to the male excess in CP, particularly at  $< 28$  and  $37+$  weeks. Higher neonatal mortality rates in males at all gestations had little impact on the CP sex ratio. There was no clearly discernible change over time in the CP sex ratio.

INTERPRETATION: Gestation-specific associations between sex and CP provide insight into causal pathways to CP and suggest sex-specific differences in response to neuroprotective strategies.

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PMID: 26762863 [PubMed - in process]

### **Cerebral palsy after neonatal encephalopathy: do neonates with suspected asphyxia have worse outcomes?**

arfinkle J, Wintermark P, Shevell MI, Oskoui M; Canadian Cerebral Palsy Registry.  
*Dev Med Child Neurol.* 2016 Feb;58(2):189-94. doi: 10.1111/dmcn.12953. Epub 2015 Nov 11.

AIM: We sought to investigate how brain injury and severity, and neurological subtype of cerebral palsy (CP) differed in term-born children with CP after neonatal encephalopathy, between those with suspected birth asphyxia and those without.

METHOD: Using the Canadian CP Registry, which included 1001 children, those with CP born at  $\geq 36$ wks after moderate or severe neonatal encephalopathy, were dichotomized according to the presence or absence of suspected birth asphyxia. Gross Motor Function Classification System (GMFCS) scores, neurological subtypes, comorbidities, and magnetic resonance imaging findings were compared.

RESULTS: Of the 147 term-born children with CP (82 males, 65 females; median age 37 months, interquartile range [IQR] 26-52.5) who after moderate or severe neonatal encephalopathy had the required outcome data, 61 (41%) met criteria for suspected birth asphyxia. They had a higher frequency of non-ambulatory GMFCS status (odds ratio [OR] 3.4, 95% confidence interval [CI] 1.72-6.8), spastic quadriplegia (OR 2.8, 95% CI 1.4-5.6), non-verbal communication skills impairment (OR 4.2, 95% CI 2.0-8.6), isolated deep grey matter injury (OR 4.1, 95% CI 1.8-9.5), a lower frequency of spastic hemiplegia (OR 0.17, 95% CI 0.07-0.42), focal injury (OR 0.20; 95% CI 0.04-0.93), and more comorbidities ( $p=0.017$ ) than those who did not meet criteria.

INTERPRETATION: Term-born children who develop CP after neonatal encephalopathy with suspected birth asphyxia have a greater burden of disability than those without suspected birth asphyxia.

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PMID: 26555029 [PubMed - in process]

### **Cerebral palsy and perinatal mortality after pregnancy-induced hypertension across the gestational age spectrum: observations of a reconstructed total population cohort.**

Blair E(1), Watson L(1),(2); Australian Cerebral Palsy Register Group.

*Dev Med Child Neurol.* 2016 Feb;58 Suppl 2:76-81. doi: 10.1111/dmcn.13014. Epub 2016 Jan 14.

AIM: Pregnancy-induced hypertension/pre-eclampsia (PIH/PE) is associated with cerebral palsy (CP) in term births but if sufficiently severe to necessitate preterm delivery predicts a lower risk of CP than observed in gestational peers. We investigated whether this apparent 'protection' was attributable to inappropriately chosen comparison groups and/or an increased risk of perinatal death.

METHOD: Perinatal information was collected from medical records of children with CP, individually matched neonatal survivors without CP, and representative samples of perinatal deaths of Western Australian birth cohorts from 1980 to 1995. Compared with these data, the sensitivity of statutorily collected PIH/PE data was assessed for each outcome group. Using these sensitivities, the estimated risks of death and CP in births to all women with and without PIH/PE were compared.

RESULTS: Sensitivity of statutory PIH/PE data decreased with increasingly poor outcome. Reconstructed cohorts showed that PIH/PE increased the risks both of CP and of perinatal death in births at lower gestations except in births <27 weeks, where the risk of perinatal death only increased greatly.

INTERPRETATION: PIH/PE does not protect against poor outcome at any gestational age. Previously reported protective effects originate from inappropriate control for gestational age and not from higher gestation-specific perinatal mortality.

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PMID: 26762763 [PubMed - in process]

### **Neurological sequelae of healthcare-associated sepsis in very-low-birthweight infants: Umbrella review and evidence-based outcome tree.**

Haller S, Deindl P, Cassini A, Suetens C, Zingg W, Abu Sin M, Velasco E, Weiss B, Ducomble T, Sixtensson M, Eckmanns T, Harder T.

*Euro Surveill.* 2016 Feb 25;21(8). doi: 10.2807/1560-7917.ES.2016.21.8.30143.

Sepsis is a frequent cause of death in very-low-birthweight infants and often results in neurological impairment. Its attributable risk of sequelae has not been systematically assessed. To establish an outcome tree for mapping the burden of neonatal sepsis, we performed systematic literature searches to identify systematic reviews addressing sequelae of neonatal sepsis. We included cohort

studies and performed meta-analyses of attributable risks. Evidence quality was assessed using GRADE. Two systematic reviews met inclusion criteria. The first included nine cohort studies with 5,620 participants and five outcomes (neurodevelopmental impairment, cerebral palsy, vision impairment, hearing impairment, death). Pooled risk differences varied between 4% (95% confidence interval (CI):2-10) and 13% (95% CI:5-20). From the second review we analysed four studies with 472 infants. Positive predictive value of neurodevelopmental impairment for later cognitive impairment ranged between 67% (95% CI:22-96) and 83% (95% CI:36-100). Neonatal sepsis increases risk of permanent neurological impairment. Effect size varies by outcome, with evidence quality being low to very low. Data were used to construct an outcome tree for neonatal sepsis. Attributable risk estimates for sequelae following neonatal sepsis are suitable for burden estimation and may serve as outcome parameters in interventional studies.  
PMID: 26940884 [PubMed - in process]

### **Placental Nutrient Transport and Intrauterine Growth Restriction.**

Gaccioli F, Lager S.

*Front Physiol.* 2016 Feb 16;7:40. doi: 10.3389/fphys.2016.00040. eCollection 2016.

Intrauterine growth restriction refers to the inability of the fetus to reach its genetically determined potential size. Fetal growth restriction affects approximately 5-15% of all pregnancies in the United States and Europe. In developing countries the occurrence varies widely between 10 and 55%, impacting about 30 million newborns per year. Besides having high perinatal mortality rates these infants are at greater risk for severe adverse outcomes, such as hypoxic ischemic encephalopathy and cerebral palsy. Moreover, reduced fetal growth has lifelong health consequences, including higher risks of developing metabolic and cardiovascular diseases in adulthood. Numerous reports indicate placental insufficiency as one of the underlying causes leading to altered fetal growth and impaired placental capacity of delivering nutrients to the fetus has been shown to contribute to the etiology of intrauterine growth restriction. Indeed, reduced expression and/or activity of placental nutrient transporters have been demonstrated in several conditions associated with an increased risk of delivering a small or growth restricted infant. This review focuses on human pregnancies and summarizes the changes in placental amino acid, fatty acid, and glucose transport reported in conditions associated with intrauterine growth restriction, such as maternal undernutrition, pre-eclampsia, young maternal age, high altitude and infection.

#### [Free PMC Article](#)

PMCID: PMC4754577

PMID: 26909042 [PubMed]

### **Prediction of Neurodevelopmental Outcome of Preterm Babies Using Risk Stratification Score.**

Sujatha R, Jain N.

*Indian J Pediatr.* 2016 Feb 26. [Epub ahead of print]

**OBJECTIVES:** To study the incidence of major neurodevelopmental disability (NDD) at 1 y age (corrected for prematurity) in a cohort of preterm Indian babies ( $\leq 33$  wk) and to predict NDD based on perinatal risk factors.

**METHODS:** This prospective cohort study was conducted at a referral neonatal intensive care unit (NICU) with a developmental follow up clinic in private sector in Kerala, India. The study was conducted for 4.5 y - January 2005 to July 2009. All preterm babies  $\leq 33$  wk at birth, discharged from the NICU were included. Pre-defined perinatal and neonatal risk factors known to affect neurodevelopmental outcome were recorded prospectively, in a structured form. Babies were followed to 1 y of age, corrected for prematurity and classified as normal or as having major neurodevelopmental disability (NDD). Major NDD was defined as cerebral palsy or Development Assessment Scale for Indian Infants (DASII) motor /mental score  $< 70$  or blindness in one or both eyes or hearing impairment needing hearing aids.

**RESULTS:** The incidence of major NDD at 1 y age (corrected for prematurity) among the 225 preterm babies was 6.2 %. A clinical score was devised by combining 5 risk factors, gestation  $\leq 28$  wk, need for extensive resuscitation at birth, symptomatic hypoglycemia, invasive ventilation for  $> 7$  d and abnormal neurosonogram. Scores of 1 to 5 were associated with 4, 6, 10, 25, 100 % risk of major NDD respectively ( $p < 0.01$ ). The authors could stratify 87.5 % of the babies into low risk (score of 1 or 2) for NDD and 12.5 % into high risk (score 3 or 4 or 5) for major NDD.

**CONCLUSIONS:** Majority of the preterm babies at lower risk of NDD need less intensive follow up, while those at higher risk (12.5 %) should be guided to more frequent structured follow up and early intervention program.

PMID: 26916889 [PubMed - as supplied by publisher]

### **Risk factors for cerebral palsy in PPROM and preterm delivery with intact membranes.**

Accordino F, Consonni S, Fedeli T, Kullman G, Moltrasio F, Ghidini A, Locatelli A.

*J Matern Fetal Neonatal Med.* 2016 Feb 26:1-6. [Epub ahead of print]

**OBJECTIVE:** Gestational age (GA) at delivery and spontaneous prematurity are independent risk factors for cerebral palsy (CP). The aim of this study is to investigate perinatal risk factors for CP in spontaneous preterm delivery.

**METHODS:** A retrospective cohort study of all single pregnancies complicated by spontaneous preterm labor (PTL) or PPROM with delivery at <34 weeks from January 2006 to December 2012 was performed. We compared demographic, obstetric, neonatal, and placental histology variables in cases of spontaneous preterm birth in reference to the development of CP. Statistical analysis included chi-square, one-way ANOVA and logistic regression analysis.  $p < 0.05$  was considered significant.

**RESULTS:** Two hundred sixty-one women were included for this study. Of 249 survivors, 5 babies died during the first year of life, 52 did not fulfill the inclusion criteria for neurologic follow-up, and 24 were lost to follow up. Thus 168 infants in the study cohort underwent neurologic follow-up. We observed 26 cases of CP. Factors related to CP were lower GA at PROM ( $p = 0.007$ ) and longer latency from PPROM to delivery ( $p = 0.002$ ) in the PPROM group, lower GA at delivery ( $p < 0.001$ ) and presence of funisitis ( $p < 0.001$ ) in the PTL group.

**CONCLUSIONS:** GA at membrane rupture in PPROM and GA at delivery in PTL are significantly associated with CP. A process leading to neurological damage may be initiated at the moment of membranes rupture in cases of PPROM and at the time of PTL in the group with intact membranes.

PMID: 26919411 [PubMed - as supplied by publisher]

### **Severe Neonatal Anaemia, MRI Findings and Neurodevelopmental Outcome.**

Zonnenberg IA, Vermeulen RJ, Rohaan MW, van Weissenbruch MM, Groenendaal F, de Vries LS.

*Neonatology.* 2016 Feb 18;109(4):282-288. [Epub ahead of print]

**BACKGROUND AND OBJECTIVE:** Severe neonatal anaemia can impair cerebral oxygen supply. Data on long-term outcomes following severe neonatal anaemia are scarce.

**METHODS:** Clinical data and neurodevelopmental outcome of 49 (near) term infants with haemoglobin concentration after birth  $< 6.0$  mmol/l were retrospectively collected and analysed. In a subgroup of 28 patients, amplitude-integrated EEG was available and in 25 infants cerebral MRI was obtained. Infants were followed up at 14-35 months of age and assessed with the Griffiths Scale of Mental Development or Bayley Scale of Infant Development.

**RESULTS:** Eighteen patients (37%) died during the neonatal period. In 25 patients MRI was performed. A predominant pattern of injury on MRI was seen in the basal ganglia and thalami in 7 patients (28%), whereas some form of white matter injury was present in 16 (64%) and a combination in 3 (12%). Follow-up data were available for 26 patients (84% of survivors). Formal assessment of neurodevelopmental outcome was performed in 20 of 31 (65%) infants who survived (median age: 19 months, range: 14-35). Sixteen infants (80%) had a developmental quotient appropriate for age in the first 2 years after birth. On motor outcome, 1 patient (5%) scored below average (Z-score -1.10). One patient developed cerebral palsy.

**CONCLUSION:** Early neurodevelopmental outcome in surviving patients with severe neonatal anaemia was within the normal range in the majority of the survivors. MRI showed mild-to-moderate white matter injury in two thirds of the infants.

Prospectively collected data with a longer follow-up period are needed.

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PMID: 26886231 [PubMed - as supplied by publisher]

### **Variation in cerebral palsy profile by socio-economic status.**

Oskoui M, Messerlian C, Blair A, Gamache P, Shevell M.

*Dev Med Child Neurol.* 2016 Feb;58(2):160-6. doi: 10.1111/dmcn.12808. Epub 2015 May 22.

**AIM:** Socio-economic differences in maternal and child health are well recognized, but the role of individual-level and area-level determinants in cerebral palsy (CP) phenotypes is debated. We set out to examine (1) the association between area-level and individual-level measures of socio-economic deprivation and CP phenotype among children, including subtype, severity, and comorbidities; and (2) the direct effect of area-level deprivation not mediated through individual-level deprivation.

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**METHOD:** Regional data from a provincial CP register were analyzed. The outcome of interest was CP phenotype. The area-level exposure was measured using the Pampalon Deprivation Index. Individual-level socio-economic status (SES) was determined using maternal education. We conducted multiple regression models, stratified by preterm birth, controlling for key covariates, and a mediation analysis of area-level deprivation on the association between individual SES and CP phenotype.

**RESULTS:** A socio-economic gradient in mobility was seen in our cohort, above and beyond differences in maternal and perinatal factors. The added direct effect of area-level deprivation was seen only in children whose mothers were educated to a higher level, suggesting no additional contribution of area-level deprivation in children of mothers with a lower level of education.

**INTERPRETATION:** Contextual socio-economic factors can impact the severity of CP. These findings indicate important areas for potential community-level or area-level public health intervention (i.e. neighborhood reinvestment, preventive measures), and suggest that neighborhood-level research in maternal and perinatal health should continue to be pursued.

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PMID: 26010819 [PubMed - in process]

## Lésions Prévention des lésions

### +Données cliniques

#### **Antepartum and intrapartum interventions to prevent preterm birth and its sequelae.**

Nijman TA, van Vliet EO, Koullali B, Mol BW, Oudijk MA.

*Semin Fetal Neonatal Med.* 2016 Feb 11. pii: S1744-165X(16)00005-6. doi:10.1016/j.siny.2016.01.004. [Epub ahead of print]

Preterm birth is the main cause of neonatal morbidity and mortality. This review provides an overview of antepartum and intrapartum management of threatened preterm birth. The most effective method to identify women at high risk of delivering within seven days is the combination of cervical length and fetal fibronectin test. Antenatal corticosteroids administered for 48 h improve neonatal outcome. Although tocolysis has been shown to prolong pregnancy, there is no evidence that tocolytic therapy improves neonatal outcomes. Intrapartum administration of magnesium sulfate improves neurologic outcomes, such as cerebral palsy and gross motor function. In women with preterm premature rupture of membranes, prophylactic antibiotic treatment with erythromycin improves short-term neonatal outcomes, but proof of long-term benefit is lacking. In threatened preterm birth with intact membranes, prophylactic antibiotic treatment is thought to be harmful. Critical appraisal of the long-term benefits and harms of all these treatments questions their use.

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PMID: 26875954 [PubMed - as supplied by publisher]

#### **Cerebral Hemodynamics in Asphyxiated Newborns Undergoing Hypothermia Therapy: Pilot Findings Using a Multiple-Time-Scale Analysis.**

Chalak LF, Tian F, Tarumi T, Zhang R.

*Pediatr Neurol.* 2016 Feb;55:30-6. doi: 10.1016/j.pediatrneurol.2015.11.010. Epub 2015 Nov 27.

**BACKGROUND:** Improved quantitative assessment of cerebral hemodynamics in newborns might enable us to optimize cerebral perfusion. Our objective was to develop an approach to assess cerebral hemodynamics across multiple time scales during the first 72 hours of life in newborns during hypothermia therapy.

**METHODS:** Spontaneous oscillations in mean arterial pressure and regional cerebral tissue oxygen saturation were analyzed using a moving window correlation method with time scales ranging from 0.15 to 8 hours in this pilot methodology study. Abnormal neurodevelopmental outcome was defined by Bayley III scores and/or cerebral palsy by age 24 months using receiver operating curve.

**RESULTS:** Multiple-time-scale correlations between the mean arterial pressure and regional cerebral tissue oxygen saturation oscillations were tested in 10 asphyxiated newborns undergoing hypothermia therapy. Large noninduced fluctuations in the blood pressure were observed during cooling in all five infants with abnormal outcomes. Notably, these infants had two distinct patterns of correlation: a positive in-phase correlation at the short time scales

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(15 minutes) and/or a negative antiphase correlations observed at long time scales (4 hours.). Both the in-phase (area under the curve 0.6, [95% confidence interval 0.2-0.95]) and antiphase correlations (area under the curve 0.75, [95% confidence interval 0.4-0.95]) appeared to be related to an abnormal outcome.

CONCLUSIONS: Our observations suggest that the time scale is an important factor that needs to be standardized in the assessment of neonatal cerebral hemodynamics.

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PMCID: PMC4748172 [Available on 2017-02-01]

PMID: 26858217 [PubMed - in process]

### **Grey matter brain injuries are common in Ugandan children with cerebral palsy suggesting a perinatal aetiology in full-term infants.**

Kakooza-Mwesige A, Byanyima RK, Tumwine JK, Eliasson AC, Forssberg H, Flodmark O.

*Acta Paediatr.* 2016 Feb 2. doi: 10.1111/apa.13352. [Epub ahead of print]

AIM: There is limited literature on brain imaging studies of children with cerebral palsy (CP) in low- and middle-income countries. We investigated neuroimaging patterns of children with CP attending a tertiary referral centre in Uganda in order to determine how they differed from studies reported from high-income countries and their relationship with prenatal and post-natal factors.

METHODS: Pre-contrast and post-contrast computed tomography (CT) scans of 78 CP children aged 2-12 years were conducted using a Philips MX 16-slice CT scanner. Two radiologists, blinded to the patient's clinical status, independently reviewed the scans.

RESULTS: Abnormal CT scans were detected in 69% of the children sampled, with very few having primary white matter injuries (4%). Primary grey matter injuries (PGMI) (44%) and normal scans (31%) were most frequent. Children with a history of hospital admission following birth were three times more likely to have PGMI (odds ratio [OR] 2.8; 95% CI 1.1- 7.1), suggesting a perinatal period with medical complications.

CONCLUSION: Brain imaging patterns in this group of CP children differed markedly from imaging studies reported from high-income countries, suggesting a perinatal aetiology in full-term infants and reduced survival in preterm infants. This article is protected by copyright. All rights reserved.

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## **Détection – Diagnostic**

### **↓Données cliniques**

#### **Limitations in the Activity of Mobility at Age 6 Years After Difficult Birth at Term: A Prospective Cohort Study.**

van Iersel PA, Algra AM, Bakker SC, Jonker AJ, Hadders-Algra M.

*Phys Ther.* 2016 Feb 4. [Epub ahead of print]

BACKGROUND: A difficult birth at term (DBAT) may manifest as fetal acidosis and low Apgar scores and is often referred to as 'perinatal asphyxia', especially when infants show signs of neonatal encephalopathy (NE). In contrast to DBAT resulting in moderate to severe NE, which is associated with neurodevelopmental disorders, little is known about prognosis of less severe forms of DBAT, with or without NE.

OBJECTIVE: The objective of this study was to evaluate the ICF-CY activity 'mobility' and other neurodevelopmental sequelae in infants with DBAT at 6 years.

METHODS: The index cohort (n=62; 35 boys) consisted of consecutive term infants with DBAT based on clinical criteria in a Dutch non-academic hospital, 1999-2005. We assessed NE according to the Sarnat grading system and excluded infants with severe NE. The matched reference cohort (n=81; 49 boys) consisted of healthy term infants. Primary outcome at 6 years was limited mobility (Movement ABC≤15(th) percentile). Secondary outcomes included learning and behavioral problems and the presence of minor neurological dysfunction (MND).

RESULTS: Three children developed cerebral palsy and were excluded from analyses. Children with DBAT more often had limited mobility than children without DBAT (RR 2.44, 95%CI 1.16-5.14). The risk of limited mobility rose with increasing severity of NE (mild NE RR 3.38, 95%CI 1.40-8.16; moderate NE RR 4.00, 95%CI 1.54-10.40), and especially manual abilities were affected (RR 4.12, 95%CI 1.40-12.14). Learning problems, need for physical therapy and complex MND were more common in children with DBAT than in children without DBAT.

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CONCLUSIONS: Term infants who develop mild or moderate NE following DBAT are at increased risk for limited mobility at 6 years; routine monitoring of neuromotor development in these children is warranted.

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PMID: 26847013 [PubMed - as supplied by publisher]

### **Optimization of MRI-based scoring scales of brain injury severity in children with unilateral cerebral palsy.**

Pagnozzi AM, Fiori S, Boyd RN, Guzzetta A, Doecke J, Gal Y, Rose S, Dowson N.

*Pediatr Radiol.* 2016 Feb;46(2):270-9. doi: 10.1007/s00247-015-3473-y. Epub 2015 Nov 10.

BACKGROUND: Several scoring systems for measuring brain injury severity have been developed to standardize the classification of MRI results, which allows for the prediction of functional outcomes to help plan effective interventions for children with cerebral palsy.

OBJECTIVE: The aim of this study is to use statistical techniques to optimize the clinical utility of a recently proposed template-based scoring method by weighting individual anatomical scores of injury, while maintaining its simplicity by retaining only a subset of scored anatomical regions.

MATERIALS AND METHODS: Seventy-six children with unilateral cerebral palsy were evaluated in terms of upper limb motor function using the Assisting Hand Assessment measure and injuries visible on MRI using a semiquantitative approach. This cohort included 52 children with periventricular white matter injury and 24 with cortical and deep gray matter injuries. A subset of the template-derived cerebral regions was selected using a data-driven region selection algorithm. Linear regression was performed using this subset, with interaction effects excluded.

RESULTS: Linear regression improved multiple correlations between MRI-based and Assisting Hand Assessment scores for both periventricular white matter (R squared increased to 0.45 from 0,  $P < 0.0001$ ) and cortical and deep gray matter (0.84 from 0.44,  $P < 0.0001$ ) cohorts. In both cohorts, the data-driven approach retained fewer than 8 of the 40 template-derived anatomical regions.

CONCLUSION: The equal or better prediction of the clinically meaningful Assisting Hand Assessment measure using fewer anatomical regions highlights the potential of these developments to enable enhanced quantification of injury and prediction of patient motor outcome, while maintaining the clinical expediency of the scoring approach.

PMID: 26554854 [PubMed - in process]

### **Predictive value of general movements' quality in low-risk infants for minor neurological dysfunction and behavioural problems at preschool age.**

Bennema AN, Schendelaar P, Seggers J, Haadsma ML, Heineman MJ, Hadders-Algra M.

*Early Hum Dev.* 2016 Mar;94:19-24. doi: 10.1016/j.earlhumdev.2016.01.010. Epub 2016 Feb 16.

BACKGROUND: General movement (GM) assessment is a well-established tool to predict cerebral palsy in high-risk infants. Little is known on the predictive value of GM assessment in low-risk populations.

AIMS: To assess the predictive value of GM quality in early infancy for the development of the clinically relevant form of minor neurological dysfunction (complex MND) and behavioral problems at preschool age.

STUDY DESIGN: Prospective cohort study.

SUBJECTS: A total of 216 members of the prospective Groningen Assisted Reproductive Techniques (ART) cohort study were included in this study. ART did not affect neurodevelopmental outcome of these relatively low-risk infants born to subfertile parents.

OUTCOME MEASURES: GM quality was determined at 2 weeks and 3 months. At 18 months and 4 years, the Hempel neurological examination was used to assess MND. At 4 years, parents completed the Child Behavior Checklist; this resulted in the total problem score (TPS), internalizing problem score (IPS), and externalizing problem score (EPS). Predictive values of definitely (DA) and mildly (MA) abnormal GMs were calculated.

RESULTS: DA GMs at 2 weeks were associated with complex MND at 18 months and atypical TPS and IPS at 4 years (all  $p < 0.05$ ). Sensitivity and positive predictive value of DA GMs at 2 weeks were rather low (13%-60%); specificity and negative predictive value were excellent (92%-99%). DA GMs at 3 months occurred too infrequently to calculate prediction. MA GMs were not associated with outcome.

CONCLUSIONS: GM quality as a single predictor for complex MND and behavioral problems at preschool age has limited clinical value in children at low risk for developmental disorders.

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PMID: 26894664 [PubMed - in process]

## **Prognostic factors for cerebral palsy and motor impairment in children born very preterm or very low birthweight: a systematic review.**

Linsell L, Malouf R, Morris J, Kurinczuk JJ, Marlow N.

*Dev Med Child Neurol.* 2016 Feb 10. doi: 10.1111/dmcn.12972. [Epub ahead of print]

IM: There is a large literature reporting risk factor analyses for poor neurodevelopment in children born very preterm (VPT:  $\leq 32$ wks) or very low birthweight (VLBW:  $\leq 1250$ g), which to date has not been formally summarized. The aim of this paper was to identify prognostic factors for cerebral palsy (CP) and motor impairment in children born VPT/VLBW.

METHOD: A systematic review was conducted using Medline, Embase, and Pyscinco databases to identify studies published between 1 January 1990 and 1 June 2014 reporting multivariable prediction models for poor neurodevelopment in VPT/VLBW children (registration number CRD42014006943). Twenty-eight studies for motor outcomes were identified.

RESULTS: There was strong evidence that intraventricular haemorrhage and periventricular leukomalacia, and some evidence that the use of postnatal steroids and non-use of antenatal steroids, were prognostic factors for CP. Male sex and gestational age were of limited use as prognostic factors for CP in cohorts restricted to  $\leq 32$  weeks gestation; however, in children older than 5 years with no major disability, there was evidence that male sex was a predictive factor for motor impairment.

INTERPRETATION: This review has identified factors which may be of prognostic value for CP and motor impairment in VPT/VLBW children and will help to form the basis of future prognostic research.

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PMID: 26862030 [PubMed - as supplied by publisher]

## **Short and long term prognosis in perinatal asphyxia: An update.**

Ahearne CE, Boylan GB, Murray DM.

*World J Clin Pediatr.* 2016 Feb 8;5(1):67-74. doi: 10.5409/wjcp.v5.i1.67. eCollection 2016.

Interruption of blood flow and gas exchange to the fetus in the perinatal period, known as perinatal asphyxia, can, if significant, trigger a cascade of neuronal injury, leading on to neonatal encephalopathy (NE) and resultant long-term damage. While the majority of infants who are exposed to perinatal hypoxia-ischaemia will recover quickly and go on to have a completely normal survival, a proportion will suffer from an evolving clinical encephalopathy termed hypoxic-ischaemic encephalopathy (HIE) or NE if the diagnosis is unclear. Resultant complications of HIE/NE are wide-ranging and may affect the motor, sensory, cognitive and behavioural outcome of the child. The advent of therapeutic hypothermia as a neuroprotective treatment for those with moderate and severe encephalopathy has improved prognosis. Outcome prediction in these infants has changed, but is more important than ever, as hypothermia is a time sensitive intervention, with a very narrow therapeutic window. To identify those who will benefit from current and emerging neuroprotective therapies we must be able to establish the severity of their injury soon after birth. Currently available indicators such as blood biochemistry, clinical examination and electrophysiology are limited. Emerging biological and physiological markers have the potential to improve our ability to select those infants who will benefit most from intervention. Biomarkers identified from work in proteomics, metabolomics and transcriptomics as well as physiological markers such as heart rate variability, EEG analysis and radiological imaging when combined with neuroprotective measures have the potential to improve outcome in HIE/NE. The aim of this review is to give an overview of the literature in regards to short and long-term outcome following perinatal asphyxia, and to discuss the prediction of this outcome in the early hours after birth when intervention is most crucial; looking at both currently available tools and introducing novel markers.

### **[Free PMC Article](#)**

PMCID: PMC4737695

PMID: 26862504 [PubMed]

## **Specific characteristics of abnormal general movements are associated with functional outcome at school age.**

Hamer EG, Bos AF, Hadders-Algra M.

*Early Hum Dev.* 2016 Feb 17;95:9-13. doi: 10.1016/j.earlhumdev.2016.01.019. [Epub ahead of print]

BACKGROUND: Assessing the quality of general movements (GMs) is a non-invasive tool to identify at early age infants at risk for developmental disorders.

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AIM: To investigate whether specific characteristics of definitely abnormal GMs are associated with developmental outcome at school age.

STUDY DESIGN: Observational cohort study (long-term follow-up).

SUBJECTS: Parents of 40 children (median age 8.3years, 20 girls) participated in this follow-up study. In infancy (median corrected age 10weeks), the children (median gestational age 30.3weeks; birth weight 1243g) had shown definitely abnormal GMs according to Hadders-Algra (2004). Information on specific GM characteristics such as the presence of fidgety movements, degree of complexity and variation, and stiff movements, was available (see Hamer et al. 2011).

OUTCOME MEASURES: A standardised parental interview (presence of CP, attendance of school for special education, Vineland Adaptive Behavior Scale to determine functional performance) and questionnaires (Developmental Coordination Disorder Questionnaire [DCD-Q] to evaluate mobility and Child Behavior Checklist to assess behaviour) were used as outcome measures.

RESULTS: Six children had cerebral palsy (CP), ten children attended a school for special education, and eight children had behavioural problems. Both the absence of fidgety movements and the presence of stiff movements were associated with CP ( $p=0.001$ ;  $p=0.003$ , respectively). Stiff movements were also related to the need of special education ( $p=0.009$ ). A lack of movement complexity and variation was associated with behavioural problems ( $p=0.007$ ). None of the GM characteristics were related to DCD-Q scores.

CONCLUSIONS: The evaluation of fidgety movements and movement stiffness may increase the predictive power of definitely abnormal GMs for motor outcome – in particular CP. This study endorses the notion that the quality of GMs reflects the integrity of the infant's brain, assisting prediction of long-term outcome.

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MID: 26896696 [PubMed - as supplied by publisher]

## **Motricité - Mobilité – Posture**

### **A potential mechanism by which torque output is preserved in cerebral palsy during fatiguing contractions of the knee extensors.**

Moreau NG, Knight H, Olson MW.

*Muscle Nerve*. 2016 Feb;53(2):297-303. doi: 10.1002/mus.24735. Epub 2015 Nov 17.

INTRODUCTION: The purpose of this study was to compare agonist and antagonist electromyography (EMG) during an isokinetic fatigue protocol in subjects with cerebral palsy (CP) and typical development (TD).

METHODS: Nine individuals with CP and 11 with TD completed 50 repetitions of maximum concentric knee extensions (KE) and flexions (KF) at 60°/second.

RESULTS: Rate of decline in peak torque for KE was significantly less in CP compared with TD. Rate of decline in agonist EMG was not significantly different between groups, but the rate of decline in antagonist EMG was significantly greater in CP. There were no differences between groups for KF.

CONCLUSIONS: Declining agonist EMG occurred in parallel with declining antagonist hamstring activity in CP, decreasing the relative opposing force and resulting in a lesser decline in net torque. This finding illustrates a potential mechanism by which net torque is preserved in those with CP who are inherently weaker. *Muscle Nerve* 53: 297-303, 2016.

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PMID: 26095979 [PubMed - in process]

### **Antecedents of cerebral palsy according to severity of motor impairment.**

Ahlin K, Himmelmann K, Nilsson S, Sengpiel V, Jacobsson B.

*Acta Obstet Gynecol Scand*. 2016 Feb 22. doi: 10.1111/aogs.12885. [Epub ahead of print]

INTRODUCTION: The purpose of this study was to determine whether antecedents and neuroimaging patterns vary according to the severity of motor impairment in children with cerebral palsy.

MATERIAL AND METHODS: A population-based study in which all 309 term-born children with spastic and dyskinetic cerebral palsy born 1983-1994 and 618 matched controls were studied. Antecedents were retrieved from obstetric records. Information on neuroimaging was retrieved from the cerebral palsy Register of Western Sweden. Cases were grouped by severity of motor impairment: mild (walks without aids), moderate (walks with aids) or severe

(dependent on wheelchair). Binary logistic regression, the Cochran-Armitage test for trends, interaction analyses and interrelationship analyses were performed.

**RESULTS:** Antecedents associated with mild motor impairment were antepartum (placental weight, maternal weight and antibiotic therapy) or intra- and postpartum adverse events (meconium-stained amniotic fluid, low Apgar score, admission to neonatal intensive care unit and neonatal encephalopathy). Antecedents associated with severe motor impairment were antepartum (congenital infection, small head circumference and brain maldevelopment) or intra- and postpartum (emergency cesarean section and maternal antibiotic therapy). Comparisons between mild and severe motor impairment revealed congenital infection, maldevelopment, neonatal encephalopathy and meconium aspiration syndrome significantly more often in the group with severe motor impairment ( $p < 0.05$ ). White matter injury was the most common neuroimaging pattern in mild motor impairment, while maldevelopment and cortical/subcortical lesions were most common in the severe motor impairment group.

**CONCLUSIONS:** Our results suggest a variation in antecedents associated with cerebral palsy, related to severity of motor impairment. Timing of antecedents corresponded to neuroimaging patterns. This article is protected by copyright.

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PMID: 26910364 [PubMed - as supplied by publisher]

### **Bimanual Fine Motor Function (BFMF) Classification in Children with Cerebral Palsy: Aspects of Construct and Content Validity.**

Elvrum AK, Andersen GL, Himmelmann K, Beckung E, Öhrvall AM, Lydersen S, Vik T.

*Phys Occup Ther Pediatr.* 2016 Feb;36(1):1-16. doi: 10.3109/01942638.2014.975314. Epub 2014 Nov 6.

The Bimanual Fine Motor Function (BFMF) is currently the principal classification of hand function recorded by the Surveillance of Cerebral Palsy in Europe (SCPE) register. The BFMF is used in a number of epidemiological studies, but has not yet been validated. **AIMS:** To examine aspects of construct and content validity of the BFMF.

**METHODS AND RESULTS:** Construct validity of the BFMF was assessed by comparison with the Manual Ability Classification System (MACS) using register-based data from 539 children born 1999-2003 (304 boys; 4-12 years). The high correlation with the MACS (Spearman's rho = 0.89, CI: 0.86-0.91,  $p < .001$ ) supports construct validity of the BFMF. The content of the BFMF was appraised through literature review, and by using the ICF-CY as a framework to compare the BFMF and MACS. The items hold, grasp and manipulate were found to be relevant to describe increasingly advanced fine motor abilities in children with CP, but the description of the BFMF does not state whether it is a classification of fine motor capacity or performance.

**CONCLUSION:** Our results suggest that the BFMF may provide complementary information to the MACS regarding fine motor function and actual use of the hands, particularly if used as a classification of fine motor capacity.

PMID: 25374154 [PubMed - in process]

### **Burke-Fahn-Marsden dystonia severity, Gross Motor, Manual Ability, and Communication Function Classification scales in childhood hyperkinetic movement disorders including cerebral palsy: a 'Rosetta Stone' study.**

Elze MC, Gimeno H, Tustin K, Baker L, Lumsden DE, Hutton JL, Lin JP.

*Dev Med Child Neurol.* 2016 Feb;58(2):145-53. doi: 10.1111/dmcn.12965. Epub 2015 Nov 30.

**AIM:** Hyperkinetic movement disorders (HMDs) can be assessed using impairment-based scales or functional classifications. The Burke-Fahn-Marsden Dystonia Rating Scale-movement (BFM-M) evaluates dystonia impairment, but may not reflect functional ability. The Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS), and Communication Function Classification System (CFCS) are widely used in the literature on cerebral palsy to classify functional ability, but not in childhood movement disorders. We explore the concordance of these three functional scales in a large sample of paediatric HMDs and the impact of dystonia severity on these scales.

**METHOD:** Children with HMDs ( $n=161$ ; median age 10y 3mo, range 2y 6mo-21y) were assessed using the BFM-M, GMFCS, MACS, and CFCS from 2007 to 2013. This cross-sectional study contrasts the information provided by these scales.

**RESULTS:** All four scales were strongly associated (all Spearman's rank correlation coefficient  $r_s > 0.72$ ,  $p < 0.001$ ), with worse dystonia severity implying worse function. Secondary dystonias had worse dystonia and less function than

primary dystonias ( $p < 0.001$ ). A longer proportion of life lived with dystonia is associated with more severe dystonia ( $r_s = 0.42$ ,  $p < 0.001$ ).

INTERPRETATION: The BFM-M is strongly linked with the GMFCS, MACS, and CFCS, irrespective of aetiology. Each scale offers interrelated but complementary information and is applicable to all aetiologies. Movement disorders including cerebral palsy can be effectively evaluated using these scales.

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PMID: 26616635 [PubMed - in process]

### **Clinical patterns of dystonia and choreoathetosis in participants with dyskinetic cerebral palsy.**

Monbaliu E, de Cock P, Ortibus E, Heyrman L, Klingels K, Feys H.

*Dev Med Child Neurol.* 2016 Feb;58(2):138-44. doi: 10.1111/dmnc.12846. Epub 2015 Jul 15.

AIM: The aim of the study was to map clinical patterns of dystonia and choreoathetosis and to assess the relation between functional classifications and basal ganglia and thalamus lesions in participants with dyskinetic cerebral palsy (CP).

METHODS: In this cross-sectional study, 55 participants with dyskinetic CP (mean age 14y 6mo, SD 4y 1mo; range 6-22y) were assessed with the Dyskinesia Impairment Scale and classified with the Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS), and Communication Function Classification System (CFCS).

RESULTS: Dystonia and choreoathetosis are simultaneously present. Median levels of dystonia (70.2%) were significantly higher than levels of choreoathetosis (26.7%) and both were significantly higher during activity than at rest (both  $p < 0.01$ ). High correlations were found between dystonia levels and GMFCS level (Spearman's rank correlation coefficient,  $r_s = 0.70$ ; 95% confidence interval [CI] 0.53-0.81;  $p < 0.01$ ) and MACS ( $r_s = 0.65$ ; 95% CI 0.47-0.81;  $p < 0.01$ ), and fair correlation with CFCS ( $r_s = 0.36$ ; 95% CI=0.11-0.57;  $p < 0.05$ ). No significant correlation was found between choreoathetosis levels and motor classifications. Finally, higher choreoathetosis levels were found in participants with pure thalamus and basal ganglia lesions ( $p = 0.03$ ) than mixed lesions, but not for dystonia ( $p = 0.41$ ).

INTERPRETATION: Dystonia and choreoathetosis increase during activity. However, dystonia predominates and seems to have a larger impact on functional abilities. Our findings further suggest that choreoathetosis seems to be more linked to pure thalamus and basal ganglia lesions than dystonia.

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PMID: 26173923 [PubMed - in process]

### **Coactivation During Dynamometry Testing in Adolescents With Spastic Cerebral Palsy.**

Eken MM, Dallmeijer AJ, Doorenbosch CA, Dekkers H, Becher JG, Houdijk H.

*Phys Ther.* 2016 Feb 25. [Epub ahead of print]

BACKGROUND: Dynamometry has been used extensively to measure knee extensor strength in individuals with cerebral palsy (CP). However, increased co-activation can lead to underestimation of agonist strength, and therefore reduce validity of strength measurements. It is yet unknown to which extent co-activation occurs during dynamometry testing, and whether co-activation is influenced by severity of CP, load levels and fatigue.

OBJECTIVE: To investigate co-activation in adolescents with and without CP during dynamometer tests and to assess the effect of Gross Motor Function Classification System (GMFCS) level, load level and fatigue on co-activation.

DESIGN: Cross-sectional observational design.

METHOD: Sixteen adolescents with CP (GMFCS I/II: N=10/6; age [13-19y]) and fifteen without CP (age [12-19y, N=15]) performed maximal isometric contractions (maximal voluntary torque, MVT) and series of submaximal dynamic contractions at low ( $\pm 65\%$ MVT), medium ( $\pm 75\%$ MVT) and high ( $\pm 85\%$ MVT) load, until fatigue. Co-activation index (CAI) was calculated for each contraction from surface electromyography (EMG) recordings from quadriceps and hamstrings.

RESULTS: Adolescents with CP classified in GMFCS-II showed significantly higher CAI than GMFCS-I and TD during maximal and submaximal contractions. No differences were observed between load levels. During series of fatiguing submaximal contractions, CAI remained constant in both groups, except for TD adolescents at the low load condition, which showed a significant decrease.

CONCLUSION: Co-activation was higher in adolescents with CP classified in GMFCS-II than TD adolescents and those in GMFCS-I, at different load levels. Within all groups, co-activation was independent of load level and fatigue. In

individuals with CP, co-activation can lead to an underestimation of agonist muscle strength, which should be taken into account while interpreting both maximal and submaximal dynamometer tests.

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PMID: 26916928 [PubMed - as supplied by publisher]

### **Construct validity and reliability of the Selective Control Assessment of the Lower Extremity in children with cerebral palsy.**

Balzer J, Marsico P, Mitteregger E, van der Linden ML, Mercer TH, van Hedel HJ.

*Dev Med Child Neurol.* 2016 Feb;58(2):167-72. doi: 10.1111/dmcn.12805. Epub 2015 May 20.

AIM: Assessing impaired selective voluntary movement control in children with cerebral palsy (CP) has gained increasing interest. We investigated construct validity and intra- and interrater reliability of the Selective Control Assessment of the Lower Extremity (SCALE).

METHOD: Thirty-nine children (21 males, 18 females) with spastic CP, mean age 12 years 6 months [range 6y 11mo-19y 9mo], Gross Motor Function Classification System (GMFCS) levels I to IV, participated. Differences in SCALE scores were determined on joint levels and between patients categorized according to their limb distribution and GMFCS levels. SCALE scores were correlated with the Fugl-Meyer Assessment, Manual Muscle Test, and Modified Ashworth Scale. To determine reliability, the SCALE was applied once and recorded on video.

RESULTS: SCALE scores differed significantly between the less and more affected leg ( $p < 0.001$ ) and between most leg joints. Total SCALE scores differed significantly between GMFCS levels I and II. Correlations with Fugl-Meyer Assessment, Manual Muscle Test, and Modified Ashworth Scale were 0.88, 0.88, and -0.55 respectively. Intraclass correlation coefficients were all above 0.9, with the minimal detectable change below 2 points.

INTERPRETATION: The SCALE appears to be a valid and reliable tool to assess selective voluntary movement control of the legs in children with spastic CP.

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PMID: 25991061 [PubMed - in process]

### **Coordination between pelvis and shoulder girdle during walking in bilateral cerebral palsy.**

Tavernese E, Paoloni M, Mangone M, Castelli E, Santilli V.

*Clin Biomech (Bristol, Avon).* 2016 Feb;32:142-9. doi:10.1016/j.clinbiomech.2015.11.020. Epub 2015 Dec 8.

BACKGROUND: Studies revealed that pelvis and shoulder girdle kinematics is impaired in children with the diplegic form of bilateral cerebral palsy while walking. The features of 3D coordination between these segments, however, have never been evaluated.

METHODS: The gait analyses of 27 children with bilateral cerebral palsy (18 males; mean age 124months) have been retrospectively reviewed from the database of a Movement Analysis Laboratory. The spatial-temporal parameters and the range-of-motions of the pelvis and of the shoulder girdle on the three planes of motion have been calculated. Continuous relative phase has been calculated for the 3D pelvis-shoulder girdle couplings on the transverse, sagittal and frontal planes of motion to determine coordination between these segments. Data from 10 typically developed children have been used for comparison.

FINDINGS: Children with bilateral cerebral palsy walk with lower velocity ( $P = 0.01$ ), shorter steps ( $P < 0.0001$ ), larger base of support ( $P < 0.01$ ) and increased duration of the double support phase ( $P = 0.005$ ) when compared to typically developed children. The mean continuous relative phase on the transverse plane has been found lower in the cerebral palsy group throughout the gait cycle ( $P = 0.003$ ), as well as in terminal stance, pre-swing and mid-swing. The age, gait speed and pelvis range-of-motions on the transverse plane have been found correlated to continuous relative phase on the transverse plane.

INTERPRETATION: Compared with typically developed children, children with bilateral cerebral palsy show a more in-phase coordination between the pelvis and the shoulder girdle on the transverse plane while walking.

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PMID: 26690753 [PubMed - in process]

### **Evaluation and management of crouch gait.**

Kedem P, Scher DM.

*Curr Opin Pediatr.* 2016 Feb;28(1):55-9. doi: 10.1097/MOP.0000000000000316.

**PURPOSE OF REVIEW:** Crouch gait is defined as excessive ankle dorsiflexion, knee and hip flexion during the stance phase. This gait disorder is common among patients with cerebral palsy. The present article brings an up-to-date literature review on the pathoanatomy, natural history, and treatment of this frequent gait abnormality.

**RECENT FINDINGS:** Hamstrings are often not shortened in patients with crouch. Patella alta must be addressed if surgery is performed. Surgical correction of joint contractures and lever arm dysfunction can be effectively achieved through a single-event multilevel surgery.

**SUMMARY:** Crouch gait is a common gait deviation, often seen among ambulatory diplegic and quadriplegic patients, once they reach the pubertal spurt, when weak muscles can no longer support a toe walking pattern because of rapidly increased weight. This form of gait is highly ineffective and might compromise walking ability over time. The anterior knee is overloaded; pain, extensor mechanism failure, and arthritis might develop. Its progressive nature often requires surgical intervention. The cause of crouch gait is multifactorial, and surgery should be tailored to meet the individual's specific anatomic and physiologic abnormalities.

PMID: 26709688 [PubMed - in process]

### **Grading and Quantification of Upper Extremity Function in Children with Spasticity.**

Wallen M, Stewart K.

*Semin Plast Surg.* 2016 Feb;30(1):5-13. doi: 10.1055/s-0035-1571257.

The World Health Organization's International Classification of Functioning, Disability and Health (ICF) provides an ideal framework within which to conceptualize grading and quantification of upper extremity function for children with spasticity. In this article the authors provide an overview of assessments and classification tools used to (1) understand upper extremity function associated with spasticity and the factors that contribute to dysfunction, (2) guide the selection of appropriate interventions, (3) identify specific muscles to target using surgical interventions and botulinum toxin-A injections, and (4) measure the outcomes of upper extremity interventions. Assessments of upper extremity function are briefly described and categorized as to whether they (1) measure children's best ability or actual performance in daily life, (2) are clinician administered or are a child/proxy report, (3) assist in planning intervention and/or measuring outcomes, and (4) evaluate unimanual or bimanual ability. In addition, measures of spasticity and hypertonicity, and classifications of static and dynamic upper extremity postures are summarized.

PMCID: PMC4749376 [Available on 2017-02-01]

PMID: 26869858 [PubMed]

### **Measuring physiological and pathological femoral anteversion using a biplanar low-dose X-ray system: validity, reliability, and discriminative ability in cerebral palsy.**

Thépaut M, Brochard S, Leboucher J, Lempereur M, Stindel E, Tissot V, Borotikar BS.

*Skeletal Radiol.* 2016 Feb;45(2):243-50. doi: 10.1007/s00256-015-2298-y. Epub 2015 Nov 27.

**OBJECTIVE:** The aims of this study were to evaluate the concurrent validity and reliability of a low-dose biplanar X-ray system (Ld-BPR) for the measurement of femoral anteversion (FA) by comparing Ld-BPR-based three-dimensional measures with CT-scan-based measures and to assess the discriminative ability of this method in children with cerebral palsy.

**MATERIALS AND METHODS:** Fifty dry femora were scanned using both a CT scan and the Ld-BPR system. Ten femora were artificially modified to mimic a range of anteversion from -30° to +60° and scanned by both modalities. FA was quantified using the images from both modalities and statistically compared for concurrent validity. Intra- and inter-observer reliability of the Ld-BPR system was also determined. Further, Ld-BPR data from 16 hemiplegic and 22 diplegic children were analyzed for its discriminative ability.

**RESULTS:** The concurrent validity between the Ld-BPR and CT-scan measures was excellent ( $R(2) = 0.83-0.84$ ) and no significant differences were found. The intra- and inter-trial reliability were excellent (ICCs = 0.98 and 0.97) with limits of agreement of (-2.28°; +2.65°) and (-2.76°; +3.38°) respectively. Further, no significant effects of angle or method were found in the sample of modified femora. Ld-BPR measures for FA were significantly different between healthy and impaired femora.

**CONCLUSIONS:** The excellent concurrent validity with the CT scan modality, the excellent reliability, and the ability to discriminate pathological conditions evaluated by this study make this radiological method suitable for a validated use across hospitals and research institutes.

PMID: 26611255 [PubMed - in process]

### **Predictors of Independent Walking in Young Children With Cerebral Palsy.**

Begnoche DM, Chiarello LA, Palisano RJ, Gracely EJ, McCoy SW, Orlin MN.

*Phys Ther.* 2016 Feb;96(2):183-92. doi: 10.2522/ptj.20140315. Epub 2015 Jun 18.

**BACKGROUND:** The attainment of walking is a focus of physical therapy intervention in children with cerebral palsy (CP) and may affect their independence in mobility and participation in daily activities. However, knowledge of determinants of independent walking to guide physical therapists' decision making is lacking.

**OBJECTIVE:** The aim of this study was to identify child factors (postural control, reciprocal lower limb movement, functional strength, and motivation) and family factors (family support to child and support to family) that predict independent walking 1 year later in young children with CP at Gross Motor Function Classification System (GMFCS) levels II and III.

**DESIGN:** A secondary data analysis of an observational cohort study was performed.

**METHODS:** Participants were 80 children with CP, 2 through 6 years of age. Child factors were measured 1 year prior to the walking outcome. Parent-reported items representing family factors were collected 7 months after study onset. The predictive model was analyzed using backward stepwise logistic regression.

**RESULTS:** A measure of functional strength and dynamic postural control in a sit-to-stand activity was the only significant predictor of taking  $\geq 3$  steps independently. The positive likelihood ratio for predicting a "walker" was 3.26, and the negative likelihood ratio was 0.74. The model correctly identified a walker or "nonwalker" 75% of the time.

**LIMITATIONS:** Prediction of walking ability was limited by the lack of specificity of child and family characteristics not prospectively selected and measurement of postural control, reciprocal lower limb movement, and functional strength 1 year prior to the walking outcome.

**CONCLUSIONS:** The ability to transfer from sitting to standing and from standing to sitting predicted independent walking in young children with CP. Prospective longitudinal studies are recommended to determine indicators of readiness for independent walking.

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PMCID: PMC4752679 [Available on 2016-08-01]

PMID: 26089044 [PubMed - in process]

### **Relations between muscle endurance and subjectively reported fatigue, walking capacity, and participation in mildly affected adolescents with cerebral palsy.**

Eken MM, Houdijk H, Doorenbosch CA, Kiezebrink FE, van Bennekom CA, Harlaar J(1), Dallmeijer AJ.

*Dev Med Child Neurol.* 2016 Feb 24. doi: 10.1111/dmcn.13083. [Epub ahead of print]

**AIM:** To investigate the relation between muscle endurance and subjectively reported fatigue, walking capacity, and participation in mildly affected adolescents with cerebral palsy (CP) and peers with typical development.

**METHOD:** In this case-control study, knee extensor muscle endurance was estimated from individual load-endurance curves as the load corresponding to a 15-repetition maximum in 17 adolescents with spastic CP (six males, 11 females; age 12-19y) and 18 adolescents with typical development (eight males, 10 females; age 13-19y). Questionnaires were used to assess subjectively reported fatigue (Pediatric Quality of Life Inventory Multidimensional Fatigue Scale) and participation (Life-Habits questionnaire). Walking capacity was assessed using the 6-minute walk test. Relations were determined using multiple regression analyses.

**RESULTS:** Muscle endurance related significantly to subjectively reported fatigue and walking capacity in adolescents with CP, while no relations were found for adolescents with typical development (subjectively reported fatigue: regression coefficient  $\beta$  [95% confidence intervals] for CP=23.72 [6.26 to 41.18], for controls=2.72 [-10.26 to 15.69]; walking capacity  $\beta$  for CP=125m [-87 to 337], for controls=2m [-86 to 89]). The 15-repetition maximum did not relate to participation in adolescents with CP.

**INTERPRETATION:** Subjectively reported fatigue and reduced walking capacity in adolescents with CP are partly caused by lower muscle endurance of knee extensors. Training of muscle endurance might contribute to reducing the experience of fatigue and improving walking capacity. Reduced muscle endurance seems to have no effect on participation.

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PMID: 26915305 [PubMed - as supplied by publisher]

### **Simulated Ankle Equinus Affects Knee Kinematics During Gait.**

Drefus LC, Hafer JF, Scher DM.

*HSS J. 2016 Feb;12(1):39-43. doi: 10.1007/s11420-015-9474-4. Epub 2015 Oct 8.*

**BACKGROUND:** It is critical to distinguish gait compensations from true abnormalities when planning interventions to improve gait in individuals with neuromuscular disorders.

**QUESTIONS/PURPOSES:** The aim of this study was to determine the effect of isolated ankle equinus on knee kinematics during the initial contact phase of gait.

**METHODS:** Ten healthy subjects (29 + 4.3 years) participated, and testing occurred in a motion analysis laboratory. This cross-sectional study investigated five gait conditions in each subject: shoe alone, shoe with unilateral ankle foot orthosis locked at neutral, 10°, 20°, and 30° of fixed ankle plantar flexion. Gait kinematics were recorded and calculated with 3D motion analysis. The difference between the shoe and each brace condition was analyzed by repeated-measures ANOVA. The primary outcome was knee flexion at initial contact.

**RESULTS:** With greater than 10° simulated ankle equinus, the primary gait compensation pattern was increased knee flexion at initial contact. A significant degree of knee flexion occurred ranging from 7° to 22°.

**CONCLUSION:** Our data suggests that observed knee flexion at initial contact may be a compensation pattern in individuals with >10° ankle equinus. However, in individuals with ≤10° ankle equinus, observed knee flexion may represent a true gait deviation. This has clinical significance in the realm of cerebral palsy for treatment planning to improve gait.

PMCID: PMC4733689 [Available on 2017-02-01]

PMID: 26855626 [PubMed]

### **Site-Specific Transmission of a Floor-Based, High-Frequency, Low-Magnitude Vibration Stimulus in Children With Spastic Cerebral Palsy.**

Singh H, Whitney DG, Knight CA, Miller F, Manal K, Kolm P, Modlesky CM.

*Arch Phys Med Rehabil. 2016 Feb;97(2):218-23. doi: 10.1016/j.apmr.2015.08.434. Epub 2015 Sep 21.*

**OBJECTIVE:** To determine the degree to which a high-frequency, low-magnitude vibration signal emitted by a floor-based platform transmits to the distal tibia and distal femur of children with spastic cerebral palsy (CP) during standing.

**DESIGN:** Cross-sectional study.

**SETTING:** University research laboratory.

**PARTICIPANTS:** Children with spastic CP who could stand independently (n=18) and typically developing children (n=10) (age range, 4-12y) participated in the study (N=28).

**INTERVENTIONS:** Not applicable.

**MAIN OUTCOME MEASURES:** The vibration signal at the high-frequency, low-magnitude vibration platform (approximately 33Hz and 0.3g), distal tibia, and distal femur was measured using accelerometers. The degree of plantar flexor spasticity was assessed using the Modified Ashworth Scale.

**RESULTS:** The high-frequency, low-magnitude vibration signal was greater (P<.001) at the distal tibia than at the platform in children with CP (.36±.06g vs .29±.05g) and controls (.40±.09g vs .24±.07g). Although the vibration signal was also higher at the distal femur (.35±.09g, P<.001) than at the platform in controls, it was lower in children with CP (.20±.07g, P<.001). The degree of spasticity was negatively related to the vibration signal transmitted to the distal tibia (Spearman  $\rho$  = -.547) and distal femur (Spearman  $\rho$  = -.566) in children with CP (both P<.05).

**CONCLUSIONS:** A high-frequency, low-magnitude vibration signal from a floor-based platform was amplified at the distal tibia, attenuated at the distal femur, and inversely related to the degree of muscle spasticity in children with spastic CP. Whether this transmission pattern affects the adaptation of the bones of children with CP to high-frequency, low-magnitude vibration requires further investigation.

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PMID: 26392035 [PubMed - in process]

### **The use of turning tasks in clinical gait analysis for children with cerebral palsy.**

Dixon PC, Stebbins J, Theologis T, Zavatsky AB.

*Clin Biomech (Bristol, Avon). 2016 Feb;32:286-94. doi:10.1016/j.clinbiomech.2015.10.010. Epub 2015 Nov 6.*

**BACKGROUND:** Turning while walking is a crucial component of locomotion that is performed using an outside (step) or inside (spin) limb strategy. The aims of this paper were to determine how children with cerebral palsy perform turning maneuvers and if specific kinematic and kinetic adaptations occur compared to their typically developing peers.

**METHODS:** Motion capture data from twenty-two children with cerebral palsy and fifty-four typically developing children were collected during straight and 90° turning gait trials. Experimental data were used to compute spatio-temporal parameters, margin of stability, ground reaction force impulse, as well as joint kinematics and kinetics.

**FINDINGS:** Both child groups preferred turning using the spin strategy. The group of children with cerebral palsy exhibited the following adaptations during turning gait compared to the typically developing group: stride length was decreased across all phases of the turn with largest effect size for the depart phase (2.02), stride width was reduced during the turn phase, but with a smaller effect size (0.71), and the average margin of stability during the approach phase of turning was reduced (effect size of 0.98). Few overall group differences were found for joint kinematic and kinetic measures; however, in many cases, the intra-subject differences between straight walking and turning gait were larger for the majority of children with cerebral palsy than for the typically developing children.

**INTERPRETATION:** In children with cerebral palsy, turning gait may be a better discriminant of pathology than straight walking and could be used to improve the management of gait abnormalities.

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PMID: 26549659 [PubMed - in process]

### **Thorax and pelvis kinematics during walking, a comparison between children with and without cerebral palsy: A systematic review.**

Swinnen E, Goten LV, Koster B, Degelaen M.

*NeuroRehabilitation. 2016 Feb 18. [Epub ahead of print]*

**BACKGROUND:** Dysfunctional postural control and pathological thorax and pelvis motions are often observed in children with cerebral palsy (CP) and can be considered as an indicator of diminished dynamic stability.

**OBJECTIVE:** The aim of this study was to identify the differences between children with CP and typically developing children in three-dimensional thorax and pelvis kinematics during walking.

**METHODS:** Three electronic databases were searched by using different combinations of keywords. The methodological quality of the studies was assessed by two researchers with the Strobe quality checklist.

**RESULTS:** Ten studies (methodological quality: 32% to 74%) with in total 259 children with CP and 220 typically developing children (mean age: 7.6 to 13.6 year) were included. Compared to typically developing children, children with bilateral CP showed an increased range of motion of the thorax, pelvis and spine during walking. The results of the children with unilateral CP were less clear.

**CONCLUSION:** In general, children with bilateral CP showed larger movement amplitudes of the trunk compared to children without CP. This increase in movement amplitudes could influence the dynamic stability of the body during walking. In children with unilateral CP, the results were less obvious and further research on this topic is required.

PMID: 26923354 [PubMed - as supplied by publisher]

### **Validity and Responsiveness of the Trunk Impairment Scale and Trunk Control Measurement Scale in Young Individuals with Cerebral Palsy.**

Pham HP, Eidem A, Hansen G, Nyquist A, Vik T, Sæther R.

*Phys Occup Ther Pediatr. 2016 Feb 18:1-13. [Epub ahead of print]*

**AIM:** This study examines construct validity and responsiveness of the Trunk Impairment Scale (TIS) and Trunk Control Measurement Scale (TCMS) in individuals with cerebral palsy (CP).

**METHODS:** Twenty-six individuals with CP (nine males), 8-29 years (mean age 17.6) with gross motor function corresponding to GMFCS I-IV, participated in three weeks of intensive and varied physical training at a health sports center. Trunk control was assessed with the TIS (includes three subscales) and TCMS (includes three subscales), and gross motor function with the Gross Motor Function Measure 66 item set (GMFM-66-IS), before and after the training period. The GMFM-66-IS was used as a comparison measure.

**RESULTS:** The median score of the TCMS subscale dynamic sitting balance, reaching (DSB-R), increased from 6 to 7 (range: 1-10;  $p = .031$ ), and there was a median change of 3 points in GMFM-66-IS score ( $p = .036$ ). There were no significant changes in the TIS. The correlations (Spearman's rho), between the TIS, TCMS, and the GMFM-66-IS (pre-scores), ranged between 0.57 and 0.75 ( $p < .003$ ). Correlations between change scores (pre- and post-scores) were



low, and not statistically significant. However, the TCMS DSB-R change score correlated significantly with hours spent on "trunk-targeted training" like paddling/rowing ( $\rho = 0.66$ ;  $p = .003$ ) and horseback riding ( $\rho = 0.54$ ;  $p = .011$ ).

**CONCLUSIONS:** Our results support construct validity of the TIS and TCMS in young individuals with CP, whereas responsiveness could not be documented. However, the correlations between the TCMS DSB-R change score and hours spent on "trunk-targeted training" suggest that this subscale may have the potential to be used in intervention studies.

PMID: 26890372 [PubMed - as supplied by publisher]

### **Walking-induced muscle fatigue impairs postural control in adolescents with unilateral spastic cerebral palsy.**

Vitiello D, Pochon L, Malatesta D, Girard O, Newman CJ, Degache F.

*Res Dev Disabil.* 2016 Feb 3;53-54:11-18. doi: 10.1016/j.ridd.2016.01.019. [Epub ahead of print]

**BACKGROUND:** Fatigue is likely to be an important limiting factor in adolescents with spastic cerebral palsy (CP).

**AIMS:** To determine the effects of walking-induced fatigue on postural control adjustments in adolescents with unilateral CP and their typically developing (TD) peers.

**METHODS:** Ten adolescents with CP ( $14.2 \pm 1.7$ yr) and 10 age-, weight- and height-matched TD adolescents ( $14.1 \pm 1.9$ yr) walked for 15min on a treadmill at their preferred walking speed. Before and after this task, voluntary strength capacity of knee extensors (MVC) and postural control were evaluated in 3 conditions: eyes open (EO), eyes closed (EC) and with dual cognitive task (EODT).

**RESULTS:** After walking, MVC decreased significantly in CP (-11%,  $P < 0.05$ ) but not in TD. The CoP area was only significantly increased in CP (90%, 34% and 60% for EO, EC and EODT conditions, respectively). The CoP length was significantly increased in the EO condition in CP and TD (20% and 21%) and was significantly increased in the EODT condition by 18% in CP only.

**CONCLUSIONS:** Unlike TD adolescents, treadmill walking for 15min at their preferred speed lead to significant knee extensor strength losses and impairments in postural control in adolescents with unilateral spastic CP.

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PMID: 26851383 [PubMed - as supplied by publisher]

## **Traitement - Rééducation motrice et cognitive**

### **Review of Therapeutic Interventions for the Upper Limb Classified by Manual Ability in Children with Cerebral Palsy.**

Shierk A, Lake A, Haas T.

*Semin Plast Surg.* 2016 Feb;30(1):14-23. doi: 10.1055/s-0035-1571256.

The aim of this literature review was to assemble an inventory of intervention strategies utilized for children diagnosed with cerebral palsy (CP) based on the Manual Ability Classification System (MACS). The purpose of the inventory is to guide physicians and therapists in intervention selection aimed at improving upper limb function in children with CP. The following databases were searched: CINAHL (Cumulative Index to Nursing and Allied Health Literature), Cochrane Database of Systematic Reviews, ERIC (Educational Research Information Center), Google Scholar, OTSeeker (Occupational Therapy Systematic Evaluation of Evidence), OVID (Ovid Technologies, Inc.), and PubMed. Inclusion criteria were whether the study (1) identified MACS levels of participants, and (2) addressed the effectiveness of intervention on upper limb function. Overall, 74 articles met the inclusion criteria. The summarized data identified 10 categories of intervention. The majority of participants across studies were MACS level II. The most frequently cited interventions were constraint-induced movement therapy (CIMT), bimanual training, and virtual reality and computer-based training. Multiple interventions demonstrated effectiveness for upper limb improvement at each MACS level. However, there is a need for additional research for interventions appropriate for MACS levels IV and V. To fully develop an intervention inventory based on manual ability, future studies need to report MACS levels of participants, particularly for splinting and therapy interventions used in combination with surgery.

PMCID: PMC4749371 [Available on 2017-02-01]

PMID: 26869859 [PubMed]

## Pharmacologie Efficacite Tolérance

### **AbobotulinumtoxinA for Equinus Foot Deformity in Cerebral Palsy: A Randomized Controlled Trial.**

Delgado MR, Tilton A, Russman B, Benavides O, Bonikowski M, Carranza J, Dabrowski E, Dursun N, Gormley M, Jozwiak M, Matthews D, Maciag-Tymecka I, Unlu E, Pham E, Tse A, Picaut P.

*Pediatrics*. 2016 Feb;137(2):1-9. doi: 10.1542/peds.2015-2830. Epub 2016 Jan 26.

**BACKGROUND:** Although botulinum toxin is a well-established treatment of focal spasticity in cerebral palsy, most trials have been small, and few have simultaneously assessed measures of muscle tone and clinical benefit.

**METHODS:** Global, randomized, controlled study to assess the efficacy and safety of abobotulinumtoxinA versus placebo in cerebral palsy children with dynamic equinus foot deformity. Patients were randomized (1:1:1) to abobotulinumtoxinA 10 U/kg/leg, 15 U/kg/leg, or placebo injections into the gastrocnemius-soleus complex (1 or both legs injected). In the primary hierarchical analysis, demonstration of benefit for each dose required superiority to placebo on the primary (change in Modified Ashworth Scale from baseline to week 4) and first key secondary (Physician's Global Assessment at week 4) end points.

**RESULTS:** Two hundred and forty-one patients were randomized, and 226 completed the study; the intention to treat population included 235 patients (98%). At week 4, Modified Ashworth Scale scores significantly improved with abobotulinumtoxinA; mean (95% confidence interval) treatment differences versus placebo were -0.49 (-0.75 to -0.23; P = .0002) for 15 U/kg/leg and -0.38 (-0.64 to -0.13; P = .003) for 10 U/kg/leg. The Physician's Global Assessment treatment differences versus placebo of 0.77 (0.45 to 1.10) for 15 U/kg/leg and 0.82 (0.50 to 1.14) for 10 U/kg/leg were also significant (both Ps < .0001). The most common treatment-related adverse event was muscular weakness (10 U/Kg/leg = 2; placebo = 1).

**CONCLUSIONS:** AbobotulinumtoxinA improves muscle tone in children with dynamic equinus resulting in an improved overall clinical impression and is well tolerated.

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PMID: 26812925 [PubMed - in process]

### **Botulinum Toxin Treatment for Limb Spasticity in Childhood Cerebral Palsy.**

Pavone V, Testa G, Restivo DA, Cannavò L, Condorelli G, Portinaro NM, Sessa G.

*Front Pharmacol*. 2016 Feb 19;7:29. doi: 10.3389/fphar.2016.00029. eCollection 2016.

CP is the most common cause of chronic disability in childhood occurring in 2-2.5/1000 births. It is a severe disorder and a significant number of patients present cognitive delay and difficulty in walking. The use of botulinum toxin (BTX) has become a popular treatment for CP especially for spastic and dystonic muscles while avoiding deformity and pain. Moreover, the combination of physiotherapy, casting, orthotics and injection of BTX may delay or decrease the need for surgical intervention while reserving single-event, multi-level surgery for fixed musculotendinous contractures and bony deformities in older children. This report highlights the utility of BTX in the treatment of cerebral palsy in children. We include techniques for administration, side effects, and possible resistance as well as specific use in the upper and lower limbs muscles.

#### [Free PMC Article](#)

PMCID: PMC4759702

PMID: 26924985 [PubMed]

### **Botulinum Toxin Treatment of Spasticity in Adults and Children.**

Moeini-Naghani I, Hashemi-Zonouz T, Jabbari B.

*Semin Neurol*. 2016 Feb;36(1):64-72. doi: 10.1055/s-0036-1571847. Epub 2016 Feb 11

Spasticity is a frequent symptom in stroke, multiple sclerosis, cerebral or spinal trauma, and cerebral palsy that affects and disables a large number of adults and children. In this review, we discuss the pathophysiology and nonpharmacologic and pharmacologic treatments of spasticity with emphasis on the role of botulinum neurotoxins (BoNTs). The world literature is reviewed on double-blind and placebo-controlled clinical trials reporting safety and efficacy of BoNT treatment in adult spasticity and spasticity of children with cerebral palsy. The evidence for efficacy is presented from recommendations of the Assessment and Therapeutics subcommittee of the American Academy of Neurology. A technical section describes the techniques and recommended doses of BoNTs in spasticity.

Thieme Medical Publishers 333 Seventh Avenue, New York, NY 10001, USA.

PMID: 26866498 [PubMed - in process]

### **Comparison of Efficacy and Side Effects of Oral Baclofen Versus Tizanidine Therapy with Adjuvant Botulinum Toxin Type A in Children With Cerebral Palsy and Spastic Equinus Foot Deformity.**

Dai AI, Aksoy SN, Demiryürek AT.

*J Child Neurol.* 2016 Feb;31(2):184-9. doi: 10.1177/0883073815587030. Epub 2015 May 21.

This retrospective study aimed to compare the therapeutic response, including side effects, for oral baclofen versus oral tizanidine therapy with adjuvant botulinum toxin type A in a group of 64 pediatric patients diagnosed with static encephalopathy and spastic equinus foot deformity. Following botulinum toxin A treatment, clinical improvement led to the gradual reduction of baclofen or tizanidine dosing to one-third of the former dose. Gross Motor Functional Measure and Caregiver Health Questionnaire scores were markedly elevated post-botulinum toxin A treatment, with scores for the tizanidine (Gross Motor Functional Measure:  $74.45 \pm 3.72$ ; Caregiver Health Questionnaire:  $72.43 \pm 4.29$ ) group significantly higher than for the baclofen group (Gross Motor Functional Measure:  $68.23 \pm 2.66$ ; Caregiver Health Questionnaire:  $67.53 \pm 2.67$ ,  $P < .001$ ). These findings suggest that the combined use of botulinum toxin A and a low dose of tizanidine in treating children with cerebral palsy appears to be more effective and has fewer side effects versus baclofen with adjuvant botulinum toxin A.

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PMID: 25999301 [PubMed - in process]

### **Pharmacokinetics and pharmacodynamics of incobotulinumtoxinA influencing the clinical efficacy in post-stroke spasticity.**

Zeuner KE, Deuschl G.

*Expert Opin Drug Metab Toxicol.* 2016 Feb 29:1-10. [Epub ahead of print]

**INTRODUCTION:** Post-stroke spasticity is a disabling neurological condition and may have a significant impact on quality of life. Ability to carry out activities of daily living is often compromised and painful contractures in the affected limbs may also develop. The prevalence of spasticity may be as high as 40% within the first year after the initial stroke event. Management of this condition focuses on improving muscle tone, function and pain. IncobotulinumtoxinA is effective in treating focal spasticity. Areas covered: This review will summarize outcomes from incobotulinumtoxin A phase III trials in upper limb spasticity. Pharmacodynamics and pharmacokinetics will also be discussed along with future studies and possible indications. Literature searches used for this review include; PubMed and www.clinicaltrials.gov searches. Congress abstracts and case reports are not included. **Expert opinion:** IncobotulinumtoxinA, is a 150 kiloDalton neurotoxin without complexing proteins and is well tolerated in patients with spasticity. There is an 80% improvement reported on spasticity and disability in several phase III studies. In the future, higher doses for upper and lower limb spasticity may be considered. Antibody formation does not seem to limit the administration of higher doses. Prospective studies are evaluating the efficacy of incobotulinumtoxin in children and adolescents with cerebral palsy. Furthermore, the clinical efficacy and immunogenic status of other botulinum neurotoxin A subtypes are currently under investigation.

PMID: 26882333 [PubMed - as supplied by publisher]

### **Respiratory Function Under Intrathecal Baclofen Therapy in Patients With Spastic Tetraplegia.**

Kishima H, Yanagisawa T, Goto Y, Oshino S, Maruo T, Tani N, Khoo HM, Hosomi K, Hirata M(1), Yoshimine T.

*Neuromodulation.* 2016 Feb 2. doi: 10.1111/ner.12394. [Epub ahead of print]

**OBJECTIVES:** Intrathecal baclofen (ITB) therapy is an effective treatment for patients with severe spasticity. However, the effect of ITB therapy on respiratory function has not been reported in detail. In this study we quantitatively analyzed the effects of ITB on the respiratory function of patients with spastic tetraplegia.

**METHODS:** We retrospectively reviewed 23 patients who were administered ITB therapy from January 2009 to December 2012. Six of these 23 patients, who had spastic tetraplegia and were able to undergo spirometric testing, were included in this study. The spasticity derived from cervical spinal cord injury in four patients and cerebral palsy (CP) in two patients. Patients' Ashworth Scale scores and spirometer measurements obtained before and 1-6 months after the start of ITB therapy were evaluated and compared.

**RESULTS:** Before ITB therapy, %FVC of all six patients was below 80%, and a restrictive respiratory disorder was diagnosed in five patients and a combined respiratory disorder in one patient. Ashworth Scale scores for both the

lower and upper extremities improved significantly with ITB therapy. Forced vital capacity (FVC), %FVC, and forced expiratory volume at one sec also improved significantly with ITB therapy.

**CONCLUSIONS:** Respiratory disorders were indeed present in our SCI and CP patients with spastic tetraplegia, and the respiratory function of these patients improved with ITB therapy. Our results suggest that ITB therapy is safe and efficacious in patients with spastic tetraplegia and respiratory dysfunction.

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PMID: 26833715 [PubMed - as supplied by publisher]

### **Sonographic and clinical effects of botulinum toxin Type A combined with extracorporeal shock wave therapy on spastic muscles of children with cerebral palsy.**

Picelli A, Marchina E, Gajofatto F, Pontillo A, Vangelista A, Filippini R, Baricich A, Cisari C, Smania N.

*Dev Neurorehabil.* 2016 Feb 18:1-5. [Epub ahead of print]

**OBJECTIVE:** The aim of this study was to compare the combined sonographic and clinical effects of botulinum toxin type A (BoNT-A) and extracorporeal shock wave therapy (ESWT) versus BoNT-A alone in children with cerebral palsy.

**METHODS:** Ten children with spastic cerebral palsy were randomly assigned to one of two groups. Group 1 received BoNT-A injection into the spastic muscles of the affected limbs plus three ESWT sessions. Group 2 received BoNT-A alone. Assessment was performed before and 1 month after injection. Sonographic outcomes were injected muscles echo intensity and their hardness percentage, and clinical outcomes the modified Ashworth scale and the Tardieu scale.

**RESULTS:** At 1-month evaluation, significant differences in the injected muscles percentage of hardness ( $P = 0.021$ ) and the modified Ashworth scale ( $P = 0.001$ ) were found between groups.

**CONCLUSIONS:** Our results support the hypothesis that the combined effects of BoNT-A and ESWT derive from their respective action on neurological and non-neural rheological components in spastic muscles.

PMID: 26890193 [PubMed - as supplied by publisher]

## **Chirurgie**

### **Combined selective dorsal rhizotomy and scoliosis correction procedure in patients with cerebral palsy.**

Muquit S, Ammar A, Nasto L, Moussa AA, Mehdian H, Vloeberghs MH.

*Eur Spine J.* 2016 Feb;25(2):372-6. doi: 10.1007/s00586-015-4179-4. Epub 2015 Aug 20.

Intrathecal baclofen (ITB) therapy for spasticity has been suggested to accelerate the development of scoliosis. We present the case of a 17-year-old female patient with cerebral palsy who had ITB therapy from the age of 11 years.

During this period, she developed a severe scoliosis measuring 86° from T11 to L4, with pain due to costo-pelvic impingement. Her baclofen pump had reached its end of life and required replacement if ITB therapy was to continue. This coincided with plans for scoliosis corrective surgery

**METHODS:** We performed scoliosis correction along with removal of baclofen pump and selective dorsal rhizotomy (SDR), as a single combined procedure. SDR was performed instead of ITB pump replacement for management of spasticity.

**RESULTS:** Following surgery, scoliosis improved to 24°. At 6 month follow-up, there was significant improvement in spasticity and quality of life.

**CONCLUSIONS:** This report illustrates the feasibility of a combined procedure to correct scoliosis and manage spasticity with SDR. We present the case details, our management and review of the published literature regarding the factors influencing treatment of scoliosis and spasticity.

PMID: 26289633 [PubMed - in process]

### **Factors predicting postoperative complications following spinal fusions in children with cerebral palsy scoliosis.**

Nishnianidze T, Bayhan IA, Abousamra O, Sees J, Rogers KJ, Dabney KW, Miller F.

*Eur Spine J.* 2016 Feb;25(2):627-34. doi: 10.1007/s00586-015-4243-0. Epub 2015 Sep 26.

**PURPOSE:** The purpose of this study was to review the postoperative complications after posterior spinal fusion (PSF) in cerebral palsy (CP) scoliosis and identify the predictive preoperative risk factors.

**METHODS:** All PSFs consecutively performed for CP scoliosis between 2004 and 2013 were reviewed. Preoperative risk score (ORS) and postoperative complications score (POCS) were used as measures of all recorded preoperative risk factors and postoperative complications, respectively.

**RESULTS:** The review included 303 children with a mean age of  $14.6 \pm 3.0$  years. Mean hospitalization was 16 days. Dependence on G-tube feeding was associated with higher POCS ( $P = 0.027$ ). Postoperative fever, seizures, and septicemia were associated with higher ORS ( $P < 0.01$ ). Specifically, postoperative pancreatitis and deep wound infections were more common in children with G-tube.

**CONCLUSION:** This study suggests that G-tube dependence is a predictive risk factor of complications after PSF in CP scoliosis. Children with G-tube need special perioperative care. No other specific preoperative risk factor predicted postoperative complications.

PMID: 26410446 [PubMed - in process]

### **Femoral derotation osteotomy with multi-level soft tissue procedures in children with cerebral palsy: Does it improve gait quality?**

Saglam Y, Ekin Akalan N, Temelli Y, Kuchimov S.

*J Child Orthop.* 2016 Feb;10(1):41-8. doi: 10.1007/s11832-015-0706-4. Epub 2015 Nov 23.

**PURPOSE:** Poor motor control and delayed thumb function and a delay in walking are the main factors which retard the natural decrease of the femoral anteversion (FA) with age. In addition, cerebral palsy (CP) patients usually have muscular imbalance around the hip as well as muscle contractures, both of which are main factors accounting for the increased FA which is commonly present in CP patients. The purpose of this retrospective study was to analyze the mid-term results of femoral derotational osteotomy (FDO) on the clinical findings, temporospatial and kinematic parameters of gait in children with CP.

**METHODS:** We performed a retrospective review of all patients diagnosed with CP and increased FA who were treated with FDO with multi-level soft tissue surgeries at a single institution between 1992 and 2011. FA assessment was done in the prone position, and internal (IR) and external rotation (ER) of the hip was measured in the absence of pelvis rotation. Surgical procedures were performed on the basis of both clinical findings and video analysis. Clinical findings, Edinburgh Visual Gait Scores (EVGS) and results from three-dimensional gait analysis were analyzed preoperatively and last follow-up.

**RESULTS:** A total of 93 patients with 175 affected extremities were included in this review. Mean age was  $6.2 \pm 3.1$  (standard deviation) at initial surgery. The average length of the follow-up period was  $6.3 \pm 3.7$  years. At the last follow-up, the postoperative hip IR had significantly decreased ( $73.9^\circ$  vs.  $46.2^\circ$ ;  $p < 0.0001$ ), the hip ER had significantly improved ( $23.8^\circ$  vs.  $37^\circ$ ;  $p < 0.0001$ ) and the popliteal angle had significantly decreased ( $64.2^\circ$  vs.  $55.8^\circ$ ;  $p < 0.0001$ ). The total EVGS showed significant improvement after FDO ( $35.2 \pm 6.4$  vs.  $22.5 \pm 6.1$ ;  $p < 0.001$ ). Computed gait analysis showed significant improvement in the foot progression angle (FPA;  $8.1^\circ$  vs.  $-16.9^\circ$ ;  $p = 0.005$ ) and hip rotation ( $-13.9^\circ$  vs.  $5.7^\circ$ ;  $p = 0.01$ ) at the last follow-up. Stance time was improved ( $60.2$  vs.  $65.1$  %;  $p = 0.02$ ) and swing time was decreased ( $39.9$  vs.  $35.2$  %;  $p = 0.03$ ). Double support time and cadence were both decreased ( $p = 0.032$  and  $p = 0.01$ ).

**CONCLUSIONS:** Our data suggest that the FDO is an appropriate treatment strategy for the correction of FA and associated in-toeing gait in children with CP. Improvements in clinical and kinematic parameters were observed in both groups after FDO with multi-level soft tissue release. The most prominent effects of FDO were on transverse plane hip rotation and FPA.

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PMCID: PMC4763149

PMID: 26597935 [PubMed]

### **Good outcome of total hip replacement in patients with cerebral palsy.**

King G, Hunt LP, Wilkinson JM, Blom AW; National Joint Registry for England, Wales, and Northern Ireland..

*Acta Orthop.* 2016 Feb 10:1-7. [Epub ahead of print]

**Background and purpose -** People with cerebral palsy (CP) often have painful deformed hips, but they are seldom treated with hip replacement as the surgery is considered to be high risk. However, few data are available on the outcome of hip replacement in these patients.

**Patients and methods -** We linked Hospital Episode

Statistics (HES) records to the National Joint Registry for England and Wales to identify 389 patients with CP who had undergone hip replacement. Their treatment and outcomes were compared with those of 425,813 patients who did not have CP. Kaplan-Meier estimates were calculated to describe implant survivorship and the curves were compared using log-rank tests, with further stratification for age and implant type. Reasons for revision were quantified as patient-time incidence rates (PTIRs). Nationally collected patient-reported outcomes (PROMS) before and 6 months after operation were compared if available. Cumulative mortality (Kaplan-Meier) was estimated at 90 days and at 1, 3, and 5 years.

Results – The cumulative probability of revision at 5 years post-surgery was 6.4% (95% CI:3.8-11) in the CP cohort as opposed to 2.9% (CI 2.9-3%) in the non-CP cohort ( $p < 0.001$ ). Patient-reported outcomes showed that CP patients had worse pain and function preoperatively, but had equivalent postoperative improvement. The median improvement in Oxford hip score at 6 months was 23 (IQR: 14-28) in CP and it was 21 (14-28) in non-CP patients. 91% of CP patients reported good or excellent satisfaction with their outcome. The cumulative probability of mortality for CP up to 7 years was similar to that in the controls after stratification for age and sex. Interpretation - Hip replacement for cerebral palsy appears to be safe and effective, although implant revision rates are higher than those in patients without cerebral palsy.

PMID: 26863583 [PubMed - as supplied by publisher]

### **Multilevel surgery in adults with cerebral palsy.**

Putz C, Döderlein L, Mertens EM, Wolf SI, Gantz S, Braatz F, Dreher T.

*Bone Joint J.* 2016 Feb;98-B(2):282-8. doi: 10.1302/0301-620X.98B2.36122.

AIMS: Single-event multilevel surgery (SEMLS) has been used as an effective intervention in children with bilateral spastic cerebral palsy (BSCP) for 30 years. To date there is no evidence for SEMLS in adults with BSCP and the intervention remains focus of debate.

METHODS: This study analysed the short-term outcome (mean 1.7 years, standard deviation 0.9) of 97 ambulatory adults with BSCP who performed three-dimensional gait analysis before and after SEMLS at one institution.

RESULTS: Two objective gait variables were calculated pre- and post-operatively; the Gillette Gait Index (GGI) and the Gait Profile Score (GPS). The results were analysed in three groups according to their childhood surgical history (group 1 = no surgery, group 2 = surgery other than SEMLS, group 3 = SEMLS). Improvements in gait were shown by a significant decrease of GPS ( $p = 0.001$ ). Similar results were obtained for both legs (GGI right side and left side  $p = 0.01$ ). Furthermore, significant improvements were found in all subgroups although this was less marked in group 3, where patients had undergone previous SEMLS.

DISCUSSION: SEMLS is an effective and safe procedure to improve gait in adults with cerebral palsy. However, a longer rehabilitation period is to be expected than found in children. SEMLS is still effective in adult patients who have undergone previous SEMLS in childhood.

TAKE HOME MESSAGE: Single-event multilevel surgery is a safe and effective procedure to improve gait disorders in Adults with bilateral spastic cerebral palsy. Cite this article: *Bone Joint J* 2016;98-B:282-8.

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PMID: 26850437 [PubMed - in process]

### **Predictors of outcome after single-event multilevel surgery in children with cerebral palsy: a retrospective ten-year follow-up study.**

Švehlík M, Steinwender G, Lehmann T, Kraus T.

*Bone Joint J.* 2016 Feb;98-B(2):278-81. doi: 10.1302/0301-620X.98B2.35959.

AIMS: Single event multilevel surgery (SEMLS) has been shown to improve gait in children with cerebral palsy (CP). However, there is limited evidence regarding long-term outcomes and factors influencing them.

METHODS: In total 39 children (17 females and 22 males; mean age at SEMLS ten years four months, standard deviation 37 months) with bilateral CP (20 Gross Motor Function Classification System (GMFCS) level II and 19 GMFCS level III) treated with SEMLS were included. Children were evaluated using gait analysis and the Gait Deviation Index (GDI) before SEMLS and one, two to three, five and at least ten years after SEMLS. A linear mixed model was used to estimate the effect of age at the surgery, GMFCS and follow-up period on GDI.

RESULTS: There was a mean improvement of 12.1 (-15.3 to 45.1) GDI points one year after SEMLS ( $p < 0.001$ ) and 10.3 (-23.1 to 44.2) GDI points ten years after SEMLS compared with before SEMLS ( $p < 0.001$ ). GMFCS level III children aged ten to 12 years had the most improvement. The GMFCS III group had more surgical procedures at the

index SEMLS ( $p < 0.001$ ) and during the follow-up period ( $p = 0.039$ ). After correcting for other factors, age at surgery was the only factor predictive of long-term results. Our model was able to explain 45% of the variance of the change in GDI at the different time points.

TAKE HOME MESSAGE: Children with GMFCS III level aged ten to 12 are the benchmark responders to SEMLS in the long-term. Cite this article: Bone Joint J 2016;98-B:278-81.

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PMID: 26850436 [PubMed - in process]

### **Selective dorsal rhizotomy as an alternative to intrathecal baclofen pump replacement in GMFCS grades 4 and 5 children.**

Ingale H, Ughratdar I, Muquit S, Moussa AA, Vloeberghs MH.

*Childs Nerv Syst.* 2016 Feb;32(2):321-5. doi: 10.1007/s00381-015-2950-9. Epub 2015 Nov 9.

BACKGROUND: Conventionally, selective dorsal rhizotomy (SDR) has been reserved for ambulant children and implantation of intrathecal baclofen (ITB) pump for non-ambulant children with cerebral palsy. Rather than replacing the ITB pump in selected Gross Motor Function Classification System (GMFCS) grades 4 and 5 children, we elected to undertake SDR instead. We discuss the rationale and outcomes.

OBJECTIVES: To assess if children with severe spasticity treated with long-term ITB pump would benefit from SDR as alternative procedure to replacement of ITB pump.

METHOD: This study is a prospective review of ten children with severe spasticity. Indications for ITB pump replacement in 3/10 children were previous ITB pump infection and the remaining seven were nearing depletion of drug delivery system. Pre- and post-SDR mean modified Ashworth scores, assessment of urological function and survey of parent/carer satisfaction were undertaken.

RESULT: Mean Ashworth score reductions post-SDR in the lower limbs and upper limbs were 2.4 and 1.70, respectively. An improvement in urological function was also noticed in 27 % of patients. Overall, 90 % of parents/carers felt that functional outcome with SDR was improved compared with that of ITB.

CONCLUSION: SDR in comparison to ITB in this subgroup is cheaper, less intrusive by avoiding refills/replacement and found to be more effective than ITB in reducing spasticity and providing ease for nursing care. We therefore suggest that consideration should be given to SDR as an alternative in patients previously implanted with ITB systems complicated by infection or nearing end of battery life.

MID: 26552383 [PubMed - in process]

### **Spastic Paralysis of the Elbow and Forearm.**

Gharbaoui I, Kania K, Cole P.

*Semin Plast Surg.* 2016 Feb;30(1):39-44. doi: 10.1055/s-0035-1571255.

As the physiologic recovery period concludes, the patient is evaluated for surgical procedures that may rebalance muscle function and correct deformity. Upper extremity function is the product of complex and highly sophisticated mechanisms working in unison, and a careful, systematic preoperative evaluation is critical. A good function of the hand cannot be achieved without adequate position of the shoulder, elbow, forearm, and wrist. The goals of surgery must be practical and clearly understood by the patient and the family.

PMCID: PMC4749374 [Available on 2017-02-01]

PMID: 26869862 [PubMed]

### **Surgical correction of scoliosis in patients with severe cerebral palsy.**

Beckmann K, Lange T, Gosheger G, Bövingloh AS, Borowski M, Bullmann V, Liljenqvist U, Schulte TL.

*Eur Spine J.* 2016 Feb;25(2):506-16. doi: 10.1007/s00586-015-4107-7. Epub 2015 Jul 9.

INTRODUCTION: There is a lack of data in the literature on surgical correction of severe neuromuscular scoliosis in patients with serious extent of cerebral palsy. The purpose of this retrospective cohort study was to analyze the radiological and clinical results after posterior-only instrumentation (group P) and combined anterior-posterior instrumentation (group AP) in severe scoliosis in patients with Gross Motor Function Classification System grades IV and V.

MATERIALS AND METHODS: All eligible patients who underwent surgery in one institution between 1997 and 2012 were analyzed, and charts, surgical reports, and radiographs were evaluated with a minimum follow-up period of 2 years.

Science Infos Paralysie Cérébrale , Février 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel 31 +33 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

RESULTS: Fifty-seven patients were included (35 in group P, 22 in group AP), with a median follow-up period of 4.1 years. The preoperative mean Cobb angles were 84° (34 % flexibility) in group P and 109° (27 % flexibility) in group AP. In group P, the Cobb angle was 39° (54 % correction) at discharge and 43° at the final follow-up, while in group AP the figures were 54° (50 % correction) at discharge and 56° at the final follow-up. Major complications occurred in 23 vs. 46 % of the patients, respectively. Preoperative curve flexibility was an important predictor for relative curve correction, independently of the type of surgery.

CONCLUSION: Posterior-only surgery appears to lead to comparable radiological results, with shorter operating times and shorter intensive-care unit and hospital stays than combined surgery. The duration of surgery was a relevant predictor for complications.

PMID: 26155897 [PubMed - in process]

### **Surgical Treatment of Pediatric Upper Limb Spasticity: The Shoulder.**

Seruya M, Johnson JD.

*Semin Plast Surg.* 2016 Feb;30(1):45-50. doi: 10.1055/s-0035-1571253.

The shoulder joint is essential for placing the hand in a functional position for reach and overhead activities. This depends on the delicate balance between abductor/adductor and internal/external rotator muscles. Spasticity alters this equilibrium, limiting the interaction of the upper limb with the environment. Classically, pediatric patients with upper limb spasticity present with an adduction and internal rotation contracture of the shoulder. These contractures are typically secondary to spasticity of the pectoralis major and subscapularis muscles and sometimes attributed to the latissimus dorsi muscle. Fractional lengthening, Z-step lengthening, or tendon release of the contributing muscle groups may help correct the adduction and internal rotation contractures. With proper diagnosis, a well-executed surgical plan, and a consistent hand rehabilitation regimen, successful surgical outcomes can be achieved.

PMCID: PMC4749372 [Available on 2017-02-01]

PMID: 26869863 [PubMed]

### **Wide-pulse-high-frequency neuromuscular electrical stimulation in cerebral palsy.**

Neyroud D, Armand S, De Coulon G, Da Silva SR, Wegrzyk J, Gondin J, Kayser B, Place N.

*Clin Neurophysiol.* 2016 Feb;127(2):1530-9. doi: 10.1016/j.clinph.2015.07.009. Epub 2015 Jul 17.

OBJECTIVE: The present study assesses whether wide-pulse-high-frequency (WPHF) neuromuscular electrical stimulation (NMES) could result in extra-force production in cerebral palsy (CP) patients as previously observed in healthy individuals.

METHODS: Ten CP and 10 age- and sex-matched control participants underwent plantar flexors NMES. Two to three 10-s WPHF (frequency: 100Hz, pulse duration: 1ms) and conventional (CONV, frequency 25Hz, pulse duration: 50μs) trains as well as two to three burst-like stimulation trains (2s at 25Hz, 2s at 100Hz, 2s at 25Hz; pulse duration: 1ms) were evoked. Resting soleus and gastrocnemii maximal H-reflex amplitude (Hmax) was normalized by maximal M-wave amplitude (Mmax) to quantify α-motoneuron modulation.

RESULTS: Similar Hmax/Mmax ratio was found in CP and control participants. Extra-force generation was observed both in CP (+18±74%) and control individuals (+94±124%) during WPHF (p<0.05). Similar extra-forces were found during burst-like stimulations in both groups (+108±110% in CP and +65±85% in controls, p>0.05).

CONCLUSION: Although the mechanisms underlying extra-force production may differ between WPHF and burst-like NMES, similar increases were observed in patients with CP and healthy controls.

SIGNIFICANCE: Development of extra-forces in response to WPHF NMES evoked at low stimulation intensity might open new possibilities in neuromuscular rehabilitation.

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PMID: 26232132 [PubMed - in process]

## **Réadaptation fonctionnelle**

### **Current Rehabilitation Practices for Children with Cerebral Palsy: Focus and Gaps.**

Anaby D, Korner-Bitensky N, Steven E, Tremblay S, Snider L, Avery L, Law M.

*Phys Occup Ther Pediatr.* 2016 Feb 11:1-15. [Epub ahead of print]



**AIMS:** To describe the focus of therapy practices in occupational and physical therapy for school-aged children with cerebral palsy, and better understand whether it is congruent with recommended practices.

**METHODS:** A Canada-wide Web-based survey was completed by 62 occupational and 61 physical therapists to identify problems, assessments, and treatment interventions for two case-based scenarios. Data were coded using the International Classification of Functioning, Disability and Health (ICF) definitions for "body functions and structure," "activity and participation," and "environment."

**RESULTS:** Physical therapists, in comparison to occupational therapists, were more likely to select interventions classed in the "body functions and structure" category (34-42% and 18-20%, respectively). Both professions focused on "activity and participation" (34-61%) when identifying problems, assessing, and intervening; attention, however, was mainly directed towards task-oriented activities such as activities of daily living and mobility. Participation in leisure or community-based activities received less attention (2-15%). The environment received limited attention for problems and assessments (4-25%), though it was an important focus of intervention (19-37%).

**CONCLUSIONS:** While body functions and structure are well-addressed, other ICF elements, specifically participation, are poorly integrated into practice. The emerging focus on the environment in therapy intervention, by modifying the context rather than changing aspects of the child, is consistent with current approaches and evidence. Knowledge translation implementation initiatives are recommended to bridge identified gaps.

PMID: 26865220 [PubMed - as supplied by publisher]

### **Effects of robotic therapy on upper-extremity function in children with cerebral palsy: A systematic review.**

Chen YP, Howard AM.

*Dev Neurorehabil.* 2016 Feb;19(1):64-71. doi: 10.3109/17518423.2014.899648. Epub 2014 Apr 11.

**OBJECTIVE:** To systematically examine the effects of robotic therapy on upper extremity (UE) function in children with cerebral palsy (CP).

**METHODS:** A systematic literature search was conducted in Pubmed, CINAHL, Cochrane, PsychInfo, TRIP, and Web of Science up to July 2013. Studies of children with CP, using robotic therapy and measures of UE were included.

**RESULTS:** Nine articles using three different robotic systems were included. Of these, seven were case studies. Overall, robotic therapy showed the potential effects as all studies reported at least one positive outcome: a moderate effect in improving reaching duration, smoothness, or decreased muscle tone, and a small to large effect in standardized clinical assessment (e.g. Fugl-Meyer).

**CONCLUSION:** This review confirms the potential for robotic therapy to improve UE function in children with CP. However, the paucity of group design studies summons the need for more rigorous research before conclusive recommendations can be made.

PMID: 24724587 [PubMed - in process]

### **Effect of suspension training versus treadmill training on gross motor abilities of children with spastic diplegic cerebral palsy: a comparative study.**

Emara HA, El-Gohary T, Al-Johani A.

*Eur J Phys Rehabil Med.* 2016 Feb 4. [Epub ahead of print]

**BACKGROUND:** Suspension training and treadmill training are commonly used for promoting functional gross motor skills in children with cerebral palsy.

**OBJECTIVE:** The aim of this study was to compare the effect of body-weight suspension training versus treadmill training on gross motor functional skills.

**DESIGN:** Assessor-blinded, randomized, controlled intervention study.

**SETTING:** Outpatient rehabilitation facility.

**POPULATION:** Twenty children with spastic diplegia (7 boys and 13 girls) in the age ranged from 6 to 8 years old were randomly allocated into two equal groups. All children were assessed at baseline, after 18-session and after 36-session. **METHODS:** During the twelve-week outpatient rehabilitation program, both groups received traditional therapeutic exercises. Additionally, one group received locomotor training using the treadmill while the other group received locomotor training using body-weight suspension through the spider cage. Assessment included dimensions "D" standing and "E" walking of the gross motor function measure, in addition to the 10-meter walking test and the five times sit to stand test. Training was applied three times per week for twelve consecutive weeks.

RESULTS: No significant difference was found in standing or walking ability for measurements taken at baseline or after 18-session of therapy. Measurements taken at 36-session showed that suspension training achieved significantly ( $P < 0.05$ ) higher average score than treadmill training for dimension D as well as for dimension E. No significant difference was found between suspension training and treadmill training regarding walking speed or sit to stand transitional skills.

CONCLUSION: Body-weight suspension training is effective in improving walking and locomotor capabilities in children with spastic diplegia. After three month suspension training was superior to treadmill training.

CLINICAL REHABILITATION IMPACT: Body-weight suspension training promotes adequate postural stability, good balance control, and less exertion which facilitates efficient and safe gait.

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PMID: 26845668 [PubMed - as supplied by publisher]

### **Home-based versus laboratory-based robotic ankle training for children with cerebral palsy: A pilot randomized comparative trial.**

Chen K, Wu YN, Ren Y, Liu L, Gaebler-Spira D, Tankard K, Lee J, Song W, Wang M, Zhang LQ.

*Arch Phys Med Rehabil.* 2016 Feb 19. pii: S0003-9993(16)00104-0. doi:10.1016/j.apmr.2016.01.029. [Epub ahead of print]

OBJECTIVE: To examine the outcomes of a home-based robotic rehabilitation and compare it to a laboratory-based robotic rehabilitation for the treatment of impaired ankles in children with cerebral palsy

DESIGN: A randomized comparative trial design comparing a home-based training group and a laboratory-based training group.

SETTING: Home versus a laboratory within a research hospital

PARTICIPANTS: Forty-one children with cerebral palsy with Gross Motor Function Classification System level I, II or III were randomly assigned to two groups. The children in the home-based and laboratory-based groups were  $8.7 \pm 2.8$  (mean  $\pm$  standard deviation) ( $n=23$ ) and  $10.7 \pm 6.0$  ( $n=18$ ) years old, respectively.

INTERVENTIONS: Six-week combined passive stretching and active movement intervention of impaired ankle in a laboratory or home environment with a portable rehabilitation robot.

PRIMARY OUTCOME MEASURES: Active dorsiflexion range of motion (as the primary outcome), mobility (6-minute walk test and timed up and go), balance (Pediatric Balance Scale), Selective Motor Control Assessment of the Lower Extremity (SCALE), spasticity Modified Ashworth Scale (MAS), passive range of motion, strength and joint stiffness.

RESULTS: Significant improvements were found for the home-based group in all biomechanical outcome measures except for passive range of motion and all clinical outcomes except the MAS. The laboratory-based group also showed significant improvements in all of the biomechanical outcome measures and all clinical outcome measures except the MAS. There were no significant differences in the outcome measures between the two groups.

CONCLUSION: These findings suggest that translation of repetitive, goal directed, biofeedback training through motivating games from the laboratory into the home environment is feasible. The benefits of home-based robotic therapy were similar to those of laboratory-based robotic therapy.

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PMID: 26903143 [PubMed - as supplied by publisher]

### **MIT-Skywalker: A Novel Gait Neurorehabilitation Robot for Stroke and Cerebral Palsy.**

Susko T, Swaminathan K, Krebs H.

*IEEE Trans Neural Syst Rehabil Eng.* 2016 Feb 25. [Epub ahead of print]

The MIT-Skywalker is a novel robotic device developed for the rehabilitation or habilitation of gait and balance after a neurological injury. It represents an embodiment of the concept exhibited by passive walkers for rehabilitation training. Its novelty extends beyond the passive walker quintessence to the unparalleled versatility among lower extremity devices. For example, it affords the potential to implement a novel training approach built upon our working model of movement primitives based on submovements, oscillations, and mechanical impedances. This translates into three distinct training modes: discrete, rhythmic, and balance. The system offers freedom of motion that forces self-directed movement for each of the three modes. This paper will present the technical details of the robotic system as well as a feasibility study done with one adult with stroke and two adults with cerebral palsy. Results of the one-month feasibility study demonstrated that the device is safe and suggested the potential

advantages of the three modular training modes that can be added or subtracted to tailor therapy to a particular patient's need. Each participant demonstrated improvement in common clinical and kinematic measurements that must be confirmed in larger randomized control clinical trials.

PMID: 26929056 [PubMed - as supplied by publisher]

### **Neuroplastic Sensorimotor Resting State Network Reorganization in Children With Hemiplegic Cerebral Palsy Treated With Constraint-Induced Movement Therapy.**

Manning KY, Menon RS, Gorter JW, Mesterman R, Campbell C, Switzer L, Fehlings D.

*J Child Neurol.* 2016 Feb;31(2):220-6. doi: 10.1177/0883073815588995. Epub 2015 Jun 15.

Using resting state functional magnetic resonance imaging (MRI), we aim to understand the neurologic basis of improved function in children with hemiplegic cerebral palsy treated with constraint-induced movement therapy. Eleven children including 4 untreated comparison subjects diagnosed with hemiplegic cerebral palsy were recruited from 3 clinical centers. MRI and clinical data were gathered at baseline and 1 month for both groups, and 6 months later for the case group only. After constraint therapy, the sensorimotor resting state network became more bilateral, with balanced contributions from each hemisphere, which was sustained 6 months later. Sensorimotor resting state network reorganization after therapy was correlated with a change in the Quality of Upper Extremity Skills Test score at 1 month ( $r = 0.79$ ,  $P = .06$ ), and Canadian Occupational Performance Measure scores at 6 months ( $r = 0.82$ ,  $P = .05$ ). This clinically correlated resting state network reorganization provides further evidence of the neuroplastic mechanisms underlying constraint-induced movement therapy.

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PMID: 26078420 [PubMed - in process]

### **Reliability and practicability of the straight leg raise test in children with cerebral palsy.**

Marsico P, Tal-Akabi A, Van Hedel HJ.

*Dev Med Child Neurol.* 2016 Feb;58(2):173-9. doi: 10.1111/dmcn.12797. Epub 2015 May 11.

AIM: Preventing restrictions to lower limb movement is part of the treatment given to children with cerebral palsy (CP). Such restrictions can be assessed using the 'straight leg raise' (SLR) test. This study investigated the interrater reliability and practicability of the SLR test in children with CP.

METHOD: Experienced physiotherapists examined 23 children with CP (6-18y; eight females, 15 males) twice. The SLR hip range of motion (ROM) was measured using an electrogoniometer, and the test was rated based on sensitizing manoeuvres and biceps femoris muscle activity. Practicability was investigated by evaluating children's subjective feedback on the tolerable ROM.

RESULTS: Intraclass correlation coefficients for the SLR hip ROM varied, ranging from 0.84 (95% CI 0.61-0.93) to 0.93 (95% CI 0.87-0.96). Physiotherapists substantially agreed on SLR ratings (Cohen's kappa=0.73). Biceps femoris muscle activity decreased significantly with the release of tension on the sciatic nerve. All children were able to communicate the location and sensation of the maximally tolerated position.

INTERPRETATION: The SLR test proved to be reliable and practicable in children with CP and might improve clinical reasoning processes. Lower limb movement restrictions in these children may partly be related to limitations in sciatic nerve mobility. Further studies should investigate if the SLR test could estimate activities in children with CP.

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PMID: 25963293 [PubMed - in process]

### **Short-term balance training with computer-based feedback in children with cerebral palsy: A feasibility and pilot randomized trial.**

Saxena S, Rao BK, Senthil KD.

*Dev Neurorehabil.* 2016 Feb 18:1-6. [Epub ahead of print]

OBJECTIVE: To assess the feasibility of using short-term balance training with computer-based visual feedback (BTVF) and its effect on standing balance in children with bilateral spastic cerebral palsy (BSCP).

METHODS: Out of the fourteen children with BSCP (mean age = 10.31 years), seven children received four sessions of BTVF (two such sessions/day, each session = 15 min) in comparison to the control group that received standard care. Feasibility was measured as percentages of recruitment, retention and safety and balance was measured using a posturography machine as sway velocity (m/s) and velocity moment (m/s(2)) during quiet standing.

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RESULTS: No serious adverse events occurred in either group. There were no differences in the retention percentages and in any clinical outcome measure between both groups.

CONCLUSION: Use of BTVF is feasible in children with BSCP but further investigation is required to estimate a dose-effect relationship.

PMID: 26889691 [PubMed - as supplied by publisher]

### **Skilled Bimanual Training Drives Motor Cortex Plasticity in Children With Unilateral Cerebral Palsy.**

Friel KM, Kuo HC, Fuller J, Ferre CL, Brandão M, Carmel JB, Bleyenheuft Y, Gowatsky JL, Stanford AD, Rowny SB, Lubner B, Bassi B, Murphy DL, Lisanby SH, Gordon AM.

*Neurorehabil Neural Repair.* 2016 Feb 11. pii: 1545968315625838. [Epub ahead of print]

BACKGROUND: Intensive bimanual therapy can improve hand function in children with unilateral spastic cerebral palsy (USCP). We compared the effects of structured bimanual skill training versus unstructured bimanual practice on motor outcomes and motor map plasticity in children with USCP.

OBJECTIVE: We hypothesized that structured skill training would produce greater motor map plasticity than unstructured practice.

METHODS: Twenty children with USCP (average age 9.5; 12 males) received therapy in a day camp setting, 6 h/day, 5 days/week, for 3 weeks. In structured skill training (n = 10), children performed progressively more difficult movements and practiced functional goals. In unstructured practice (n = 10), children engaged in bimanual activities but did not practice skillful movements or functional goals. We used the Assisting Hand Assessment (AHA), Jebsen-Taylor Test of Hand Function (JTTHF), and Canadian Occupational Performance Measure (COPM) to measure hand function. We used single-pulse transcranial magnetic stimulation to map the representation of first dorsal interosseous and flexor carpi radialis muscles bilaterally.

RESULTS: Both groups showed significant improvements in bimanual hand use (AHA;  $P < .05$ ) and hand dexterity (JTTHF;  $P < .001$ ). However, only the structured skill group showed increases in the size of the affected hand motor map and amplitudes of motor evoked potentials ( $P < .01$ ). Most children who showed the most functional improvements (COPM) had the largest changes in map size.

CONCLUSIONS: These findings uncover a dichotomy of plasticity: the unstructured practice group improved hand function but did not show changes in motor maps. Skill training is important for driving motor cortex plasticity in children with USCP.

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PMID: 26867559 [PubMed - as supplied by publisher]

### **The Influence of a Constraint and Bimanual Training Program Using a Variety of Modalities, on Upper Extremity Functions and Gait Parameters Among Children with Hemiparetic Cerebral Palsy: A Case Series.**

Cohen-Holzer M, Sorek G, Schless S, Kerem J, Katz-Leurer M.

*Phys Occup Ther Pediatr.* 2016 Feb;36(1):17-27. doi: 10.3109/01942638.2014.990549. Epub 2014 Dec 18.

AIM: To assess the influence of an intensive combined constraint and bimanual upper extremity (UE) training program using a variety of modalities including the fitness room and pool, on UE functions as well as the effects of the program on gait parameters among children with hemiparetic cerebral palsy.

METHODS: Ten children ages 6-10 years participated in the program for 2 weeks, 5 days per week for 6 hr each day. Data from the Assisting Hand Assessment (AHA) for bimanual function, the Jebsen-Taylor Test of Hand Function (JTTHF) for unimanual function, the six-minute walk test (6MWT), and the temporal-spatial aspects of gait using the GAITRite walkway were collected prior to, immediately post and 3-months post-intervention.

RESULTS: A significant improvement was noted in both unimanual as well as bimanual UE performance; A significant improvement in the 6MWT was noted, from a median of 442 meter [range: 294-558] at baseline to 466 [432-592] post intervention and 528 [425-609] after 3 months ( $p = .03$ ).

CONCLUSION: Combining intensive practice in a variety of modalities, although targeting to the UE is associated with substantial improvement both in the upper as well as in the lower extremity function.

PMID: 25521486 [PubMed - in process]

### **The effects of intensive bimanual training with and without tactile training on tactile function in children with unilateral spastic cerebral palsy: A pilot study.**

Kuo HC, Gordon AM, Henrionnet A, Hautfenne S, Friel KM,

Bleyenheuft Y(6).

*Res Dev Disabil.* 2016 Feb-Mar;49-50:129-39. doi: 10.1016/j.ridd.2015.11.024. Epub 2015 Dec 14.

Children with unilateral spastic cerebral palsy (USCP) often have tactile impairments. Intensive bimanual training improves the motor abilities, but the effects on the sensory system have not been studied. Here we compare the effects of bimanual training with and without tactile training on tactile impairments. Twenty children with USCP (6-15.5 years; MACS: I-III) were randomized to receive either bimanual therapy (HABIT) or HABIT+tactile training (HABIT+T). All participants received 82h of standardized HABIT. In addition 8 sessions of 1h were provided to both groups. The HABIT+T group received tactile training (without vision) using materials of varied shapes and textures. The HABIT group received training with the same materials without tactile directed training (full vision). Primary outcomes included grating orientation task/GOT and stereognosis. Secondary outcomes included two-point discrimination/TPD, Semmes-Weinstein monofilaments/SWM. The GOT improved in both groups after training, while stereognosis of the more-affected hand tended to improve (but  $p=0.063$ ). No changes were found in the TPD and the SWM. There were no group $\times$ test interactions for any measure. We conclude tactile spatial resolution can improve after bimanual training. Either intensive bimanual training alone or incorporation of materials with a diversity of shapes/textures may drive these changes.

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PMID: 26698408 [PubMed - in process]

### **Translating Evidence to Increase Quality and Dose of Upper Limb Therapy for Children with Unilateral Cerebral Palsy: A Pilot Study.**

Sakzewski L, Ziviani J, Boyd RN.

*Phys Occup Ther Pediatr.* 2016 Feb 9:1-25. [Epub ahead of print]

**AIMS:** To pilot efficacy of a tailored multifaceted implementation program to change clinical practice of occupational therapists (OTs) providing upper limb (UL) therapy for children with unilateral cerebral palsy (UCP).

**METHODS:** This before and after study piloted a multifaceted implementation program comprising audit/feedback, barrier identification, and education. Medical chart audits were conducted prior to and 12 months after the intervention. Primary process outcomes included proportion of children with UCP with (1) goals set; (2) goals measured; (3) received contemporary motor learning approach; (4) an adequate dose (30-40 hours); and (5) measured UL outcomes.

**RESULTS:** Three teams of OTs ( $n = 9$ ) participated. Forty-three audits at baseline and 53 at 12 months postimplementation program were conducted. Average time to complete audits was 10 min and four out of the five evidence criteria had complete data extracted from files. Changes in clinical behavior included greater measurement of goals before (+17%) and after (+22%) therapy; use of constraint therapy (+38%), bimanual therapy (+26%), home programs (+14%); measurement of UL outcomes before (+29%) and after (+23%) therapy. Children receiving the target dose increased from 0 to 10%.

**CONCLUSIONS:** A tailored multifaceted implementation program was feasible to implement and led to meaningful changes in clinical practice behavior.

PMID: 26861242 [PubMed - as supplied by publisher]

### **Stimulation cérébrale - Stimulation neurosensorielle**

#### **Spinal inhibition and motor function in adults with spastic cerebral palsy.**

Condliffe EG, Jeffery DT, Emery DJ, Gorassini MA.

*J Physiol.* 2016 Feb 4. doi: 10.1113/JP271886. [Epub ahead of print]

Reduced inhibition of spinal motoneurons by sensory pathways may contribute to heightened reflex activity, spasticity and impaired motor function in individuals with cerebral palsy (CP). To measure if the activation of inhibitory post-synaptic potentials (IPSPs) by sensory inputs is reduced in CP, the tonic discharge rate of single motor units from the soleus muscle was plotted time-locked to the occurrence of a sensory stimulation to produce Peri-Stimulus Frequencygrams (PSFs). Stimulation to the medial arch of the foot was used to activate cutaneomuscular afferents in 17 adults with bilateral spastic CP and 15 neurologically intact (NI) peers. Evidence of IPSP activation from the PSF profiles, namely a marked pause or reduction in motor unit firing rates at the onset of the cutaneomuscular reflex, was found in all NI participants but in only half of participants with CP. In the other half of

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participants with CP, stimulation of cutaneomuscular afferents produced a PSF profile indicative of a pure excitatory post-synaptic potential (EPSP), with firing rates increasing above the mean pre-stimulus rate for 300 ms or more. The amplitude of motoneuron inhibition during the period of IPSP activation, as measured from the surface electromyogram, was less in participants with poor motor function as evaluated with the Gross Motor Functional Classification System ( $r = 0.72$ ,  $p < 0.001$ ) and the Functional Mobility Scale ( $r = -0.82$ ,  $p < 0.001$ ). These findings demonstrate that in individuals with CP, reduced activation of motoneuron IPSPs by sensory inputs is associated with reduced motor function and may contribute to enhanced reflexes and spasticity in CP. This article is protected by copyright. All rights reserved.

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PMID: 26842905 [PubMed - as supplied by publisher]

### **Réalité virtuelle - Jeux video**

#### **A randomized controlled trial of web-based training to increase activity in children with cerebral palsy.**

Mitchell LE, Ziviani J, Boyd RN.

*Dev Med Child Neurol.* 2016 Feb 15. doi: 10.1111/dmcn.13065. [Epub ahead of print]

**AIM:** To determine the efficacy of web-based training on activity capacity and performance in children with unilateral cerebral palsy (CP).

**METHOD:** In a matched-pairs randomized waitlist controlled trial, independently ambulant children and adolescents with unilateral CP were allocated to receive 30 minutes of training (intervention) 6 days per week, or usual care (waitlist control) for 20 weeks. Activity capacity was assessed using maximal repetitions of functional strength tasks and 6-minute walk test (6MWT); performance using 4-day ActiGraph GT3X+ accelerometer records at baseline and 20 weeks. Data were analysed by intention to treat comparing between groups using hierarchical linear modelling.

**RESULTS:** Participants were  $n=101$ , 52 males, mean age 11 years 3 months (SD 2y 4mo). Intervention participants completed a mean 32.4 hours (SD 17.2) of training, associated with significant improvements in functional strength (mean difference 19.3 repetitions; 95% confidence interval [CI] 10.8-27.7;  $p < 0.001$ ) and 6MWT distance (mean difference 38.9m; 95% CI 12.3-51.9;  $p < 0.001$ ) compared with the control group at 20 weeks, although not activity performance ( $p > 0.05$ ).

**INTERPRETATION:** Training was effective at increasing functional strength and walking endurance in independently ambulant children with unilateral CP. This did not translate into improvements in activity performance.

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PMID: 26877078 [PubMed - as supplied by publisher]

#### **The Effects of Nintendo Wii-Fit Video Games on Balance in Children with Mild Cerebral Palsy.**

*Pediatr Int.* 2016 Feb 9. doi: 10.1111/ped.12942. [Epub ahead of print]

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

**BACKGROUND:** This study aimed to compare the effects of Nintendo Wii-Fit balance-based video games and conventional balance training in children with mild Cerebral Palsy (CP).

**METHODS:** This randomized controlled trial included thirty ambulatory pediatric patients (5 to 18 years) with CP. Participants were randomized to either conventional balance training group (Control Group) or Wii-Fit balance-based video games group (Wii Group). Both group received Neuro-developmental treatment (NDT) during 24 sessions. In addition, while control group received conventional balance training in each session, Wii group performed Nintendo Wii Fit games like ski slalom, tightrope walk and soccer heading on balance board. Primary outcomes were Functional Reach Test (forward and sideways), Sit-to-Stand Test and Timed Get up and Go Test. Nintendo Wii Fit balance, age and game scores, 10-meter walk test, 10-step climbing test and Wee-Functional Independence Measure (Wee FIM) were secondary outcomes.

**RESULTS:** After the treatment, changes at balance scores and independence level in activities of daily living were significant ( $p < 0.05$ ) in both groups. Statistically significant improvements were found in Wii-based game group over control group in all balance tests and total Wee FIM score ( $p < 0.05$ ).

**CONCLUSION:** Wii-fit balance based video games are better at improving both static and performance-related balance parameters when combined with NDT treatment in children with mild CP.

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PMID: 26858013 [PubMed - as supplied by publisher]

## **The effects of virtual reality based bilateral arm training on hemiplegic children's upper limb motor skills.**

Do JH, Yoo EY, Jung MY, Park HY.

*NeuroRehabilitation*. 2016 Feb 18. [Epub ahead of print]

**BACKGROUND:** Hemiplegic cerebral palsy is a neurological symptom appearing on the unilateral arm and leg of the body that causes affected upper/lower limb muscle weakening and dysesthesia and accompanies tetany and difficulties in postural control due to abnormal muscle tone, and difficulties in body coordination.

**OBJECTIVES:** The purpose of this study was to examine the impact of virtual reality-based bilateral arm training on the motor skills of children with hemiplegic cerebral palsy, in terms of their upper limb motor skills on the affected side, as well as their bilateral coordination ability.

**METHODS:** The research subjects were three children who were diagnosed with hemiplegic cerebral palsy. The research followed an ABA design, which was a single-subject experimental design. The procedure consisted of a total of 20 sessions, including four during the baseline period (A1), 12 during the intervention period (B), and four during the baseline regression period (A2). For the independent variable bilateral arm training based on virtual reality, Nintendo Wii game was played for 30 minutes in each of the 12 sessions. For the dependent variables of upper limb motor skills on the affected side and bilateral coordination ability, a Wolf Motor Function Test (WMFT) was carried out for each session and the Pediatric Motor Activity Log (PMAL) was measured before and after the intervention, as well as after the baseline regression period. To test bilateral coordination ability, shooting baskets in basketball with both hands and moving large light boxes were carried out under operational definitions, with the number of shots and time needed to move boxes measured. The results were presented using visual graphs and bar graphs.

**RESULTS:** The study's results indicated that after virtual reality-based bilateral arm training, improvement occurred in upper limb motor skills on the affected sides, and in bilateral coordination ability, for all of the research subjects. Measurements of the effects of sustained therapy after completion of the intervention, during the baseline regression period, revealed that upper limb motor skills on the affected side and bilateral coordination ability were better than in the baseline period for all subjects.

**CONCLUSION:** This study confirmed that for children with hemiplegic with cerebral palsy, bilateral arm training based on virtual reality can be an effective intervention method for enhancing the upper limb motor skills on the affected side, as well as bilateral coordination ability.

PMID: 26923353 [PubMed - as supplied by publisher]

## **Thérapie cellulaire Médecine régénérative**

### **In the Know and in the News: How Science and the Media Communicate About Stem Cells, Autism and Cerebral Palsy.**

Sharpe K, Di Pietro N, Illes J.

*Stem Cell Rev*. 2016 Feb;12(1):1-7. doi: 10.1007/s12015-015-9627-3.

Stem cell research has generated considerable attention for its potential to remediate many disorders of the central nervous system including neurodevelopmental disorders such as autism spectrum disorder (ASD) and cerebral palsy (CP) that place a high burden on individual children, families and society. Here we characterized messaging about the use of stem cells for ASD and CP in news media articles and concurrent dissemination of discoveries through conventional science discourse. We searched LexisNexis and Canadian Newsstand for news articles from the US, UK, Canada and Australia in the period between 2000 and 2014, and PubMed for peer reviewed articles for the same 10 years. Using in-depth content analysis methods, we found less cautionary messaging about stem cells for ASD and CP in the resulting sample of 73 media articles than in the sample of 87 science papers, and a privileging of benefits over risk. News media also present stem cells as ready for clinical application to treat these neurodevelopmental disorders, even while the science literature calls for further research. Investigative news reports that explicitly quote researchers, however, provide the most accurate information to actual science news. The hope, hype, and promise of stem cell interventions for neurodevelopmental disorders, combined with the extreme vulnerability of these children and their families, creates a perfect storm in which journalists and stem cell scientists must commit to a continued, if not even more robust, partnership to promote balanced and accurate messaging.

PMID: 26454430 [PubMed - in process]

## Douleur

### **Hip pain is more frequent in severe hip displacement: a population-based study of 77 children with cerebral palsy.**

Ramstad K, Terjesen T.

*J Pediatr Orthop B.* 2016 Feb 18. [Epub ahead of print]

The aim of this study was to assess whether hip pain was associated with radiographic hip displacement (migration percentage, MP) in a population-based cohort of children with cerebral palsy. Seventy-seven children, mean age 9.5 (SD 1.6) years and Gross Motor Function Classification System level III-V, were assessed. Caregivers responded to the Child Health Questionnaire pain questions and located recurrent pain on a body map. Hip pain was reported in 22 children (29%) and 27 hips (18%). Hip pain was significantly more frequent in hips with MP more than or equal to 50%, in children with spastic quadriplegia, and in those with Gross Motor Function Classification System level V. We conclude that severe hip displacement with MP more than or equal to 50% was associated with hip pain, whereas slight or moderate subluxation did not influence the occurrence of such pain.

PMID: 26895291 [PubMed - as supplied by publisher]

### **Pain in Children and Adolescents with Cerebral Palsy A Population Based Registry Study.**

Alriksson-Schmidt A, Hägglund G.

*Acta Paediatr.* 2016 Feb 16. doi: 10.1111/apa.13368. [Epub ahead of print]

AIM: We assessed prevalence and location of pain in a total population of children and adolescents with cerebral palsy (CP) based on the Gross Motor Function Classification System (GMFCS), age and gender.

METHODS: This cross-sectional study was based on the last assessment of children aged 1-14 years in the combined Swedish follow-up programme and national quality register programme for CP. All were born 2001-2012 and reported to the registry in 2013-2014. Logistic regression was used to regress age, gender and the GMFCS level on the presence of pain. We also assessed pain sites among GMFCS groups.

RESULTS: We included 2,777 children (57% boys) at a median age of seven years; 32.4% reported pain, with significantly more girls than boys experiencing pain and significantly more children at GMFCS levels III and V than GMFCS I. Pain frequency increased with age and differences among GMFCS levels were found in the lower extremities and abdomen. Pain in the abdomen and hips was most frequent at GMFCS V, knee pain at level III and foot pain at level I.

CONCLUSION: Our results showed that although a lower prevalence than in many other studies, pain constituted a significant problem in children and adolescents with CP. This article is protected by copyright. All rights reserved.

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PMID: 26880375 [PubMed - as supplied by publisher]

## Langage -parole-communication

### **Reliability of the Dutch-language version of the Communication Function Classification System and its association with language comprehension and method of communication.**

Vander Zwart KE, Geytenbeek JJ, de Kleijn M, Oostrom KJ, Gorter JW, Hidecker MJ, Vermeulen RJ.

*Dev Med Child Neurol.* 2016 Feb;58(2):180-8. doi: 10.1111/dmcn.12839. Epub 2015 Jul 1.

AIM: The aims of this study were to determine the intra- and interrater reliability of the Dutch-language version of the Communication Function Classification System (CFCS-NL) and to investigate the association between the CFCS level and (1) spoken language comprehension and (2) preferred method of communication in children with cerebral palsy (CP).

METHOD: Participants were 93 children with CP (50 males, 43 females; mean age 7y, SD 2y 6mo, range 2y 9mo-12y 10mo; unilateral spastic [n=22], bilateral spastic [n=51], dyskinetic [n=15], ataxic [n=3], not specified [n=2]; Gross Motor Function Classification System level I [n=16], II [n=14], III, [n=7], IV [n=24], V [n=31], unknown [n=1]), recruited from rehabilitation centres throughout the Netherlands. Because some centres only contributed to part of the study, different numbers of participants are presented for different aspects of the study. Parents and speech and language therapists (SLTs) classified the communication level using the CFCS. Kappa was used to determine the intra- and interrater reliability. Spearman's correlation coefficient was used to determine the association between CFCS level

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and spoken language comprehension, and Fisher's exact test was used to examine the association between the CFCS level and method of communication.

**RESULTS:** Interrater reliability of the CFCS-NL between parents and SLTs was fair ( $r=0.54$ ), between SLTs good ( $r=0.78$ ), and the intrarater (SLT) reliability very good ( $r=0.85$ ). The association between the CFCS and spoken language comprehension was strong for SLTs ( $r=0.63$ ) and moderate for parents ( $r=0.51$ ). There was a statistically significant difference between the CFCS level and the preferred method of communication of the child ( $p<0.01$ ). Also, CFCS level classification showed a statistically significant difference between parents and SLTs ( $p<0.01$ ).

**INTERPRETATION:** These data suggest that the CFCS-NL is a valid and reliable clinical tool to classify everyday communication in children with CP. Preferably, professionals should classify the child's CFCS level in collaboration with the parents to acquire the most comprehensive information about the everyday communication of the child in various situations both with familiar and with unfamiliar partners.

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## Sommeil

### **Distinctive sleep problems in children with perinatal moderate or mild hypoxic-ischemia.**

Ding X, Cheng Z, Sun B, Huang J, Wang L, Han X, Yang Y, Xu W, Cao X, Miao P, Wang Y, Guo W, Gu Q, Feng X. *Neurosci Lett.* 2016 Feb 12;614:60-4. doi: 10.1016/j.neulet.2015.12.061. Epub 2016 Jan 4.

Extensive studies focus on the cognitive and motor impairments after perinatal hypoxic-ischemia (HI). Sleep problems, although reported to be associated with cerebral palsy (CP), are often overlooked in non-severe HI patients. Here, by investigating the sleep qualities of children with different degrees of HI, we discovered that sleep initiation and maintenance, sleep-related breathing problems, or circadian rhythmic issues were highly associated with children of moderate or mild HI, respectively. Follow-up MRI studies in 2-year old patients showed that periventricular white matter lesions including periventricular leukomalacia (PVL) were prevalent in moderate, but not mild, HI children. In contrast, the occurrence of pineal cysts had a high risk in children with mild HI. Our study provides novel insights into the mechanisms of distinctive sleep problems associated with children of different degrees of HI, and therefore sheds light on the studies of targeted therapeutic treatments for sleep disorders in children who suffer from HI.

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PMID: 26762786 [PubMed - in process]

## Autres Troubles /troubles concomitants

### ✚ Troubles respiratoires

### **Association Between Chronic Aspiration and Chronic Airway Infection with *Pseudomonas aeruginosa* and Other Gram-Negative Bacteria in Children with Cerebral Palsy.**

Gerdung CA, Tsang A, Yasseen AS 3rd, Armstrong K, McMillan HJ, Kovesi T. *Lung.* 2016 Feb 16. [Epub ahead of print]

**PURPOSE:** Children with cerebral palsy (CP) are at an increased risk for aspiration, and subsequent pneumonia or pneumonitis. Pneumonia is a common cause of hospital admission, intensive care unit (ICU) admission, and death in patients with CP, and may disproportionately contribute to mortality. The role of respiratory microflora is unknown. This study examined the relationship between respiratory infections with Gram-negative bacteria (GNB), particularly *Pseudomonas aeruginosa*, and the frequency/severity of pneumonia hospitalization.

**METHODS:** Retrospective chart review of 69 patients with CP and hospitalization for pneumonia. Eligible patients required hospitalization for bacterial pneumonia, at least one respiratory culture, and fulfillment of Bax definition of CP. Group assignment was based on respiratory culture. Charts were analyzed for comorbid illness, hospitalization demographics, and disease severity.

**RESULTS:** Children with isolation of *P. aeruginosa* or other GNB had increased frequency of ICU admission (77.4, 65.1, vs. 26.9 %, respectively,  $p < 0.01$ ), intubation (45.2, 39.5 vs. 11.5 %,  $p = 0.02$ ,  $p = 0.03$  respectively), and large

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pleural effusions (37.5, vs. 0 %) than children without GNB. Children with isolation of GNB had more prolonged hospitalizations and were more likely to have multiple hospitalizations than those without GNB.

**CONCLUSION:** Colonization with *P. aeruginosa* and other Gram-negative organisms in children with CP is associated with increased morbidity, prolonged hospitalization, and severity of pneumonia including need for PICU admission and intervention. Further research is required to determine causality, the role of antimicrobials active against Gram negative in pneumonia treatment, and the role of GNB eradication therapy in children with CP.

PMID: 26883134 [PubMed - as supplied by publisher]

## Troubles de la vision

### **Strabismus, a preventable barrier to social participation: a short report.**

Blair E, Smithers-Sheedy H; Australian Cerebral Palsy Register Group.

*Dev Med Child Neurol.* 2016 Feb;58 Suppl 2:57-9. doi: 10.1111/dmnc.13020. Epub 2016 Jan 14

Isolated strabismus does not significantly impair visual functionality and has traditionally been considered a primarily cosmetic defect of little importance. However, even in the absence of strabismus amblyopia, manifest strabismus and its non-surgical treatments can render the person less socially acceptable, creating a barrier to participation and resulting in psychosocial disadvantage that has been documented in the typically developing population. The Australian Cerebral Palsy Register traditionally recorded strabismus only if it were not accompanied by visual impairment; however, even these data indicate that the proportion of cerebral palsy registrants with strabismus is many times higher than in comparable population samples, compounding their challenges to achieve participation. It is therefore inappropriate to continue to consider strabismus as merely a cosmetic defect, but one that deserves surgical correction early in life.

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PMID: 26762817 [PubMed - in process]

## Psychologie – Comportement

### **Screening for psychopathology in a national cohort of 8- to 15-year-old children with cerebral palsy.**

*Res Dev Disabil.* 2016 Feb-Mar;49-50:171-80. doi: 10.1016/j.ridd.2015.11.019. Epub 2015 Dec 17.

Rackauskaite G, Bilenberg N, Bech BH, Uldall P, Østergaard JR.

Cerebral palsy (CP) is often accompanied by psychopathology and learning disability. AIMS: (1) to evaluate the prevalence of psychopathology as estimated by the Child Behavior Checklist (CBCL) parental questionnaire in 8- to 15-year-old Danish children with CP and to analyze its association with cognitive ability and families' social characteristics; (2) to examine to what extent children with CP had been evaluated by a child psychiatrist and/or psychologist.

**METHOD:** The parents of 462 children with CP answered a questionnaire about their child's treatment and the family's characteristics and 446 the CBCL. The cutoff for psychopathology was the Total CBCL score or DSM-oriented scores above the 93rd percentile in an age- and gender-stratified population.

**RESULTS:** The psychopathology screening was positive in 46.2% (CI 41.6-50.8%) against 15.1% in general population. Cognitive disability was associated with an increased prevalence of psychopathology (odds ratio (OR) 2.6, CI 1.4-4.6, for Developmental Quotient of cognitive function (DQ) 50-85 and OR 3.0, CI 1.3-7.0, for DQ<50). Children with CP and a single parent showed increased odds for a positive CBCL screening compared to children living with two parents (OR 2.1, 95% CI 1.1-4.0). Children with DQ 50-85 more often had a psychological evaluation. A positive CBCL screening was strongly associated with a psychiatric assessment (21% vs. 7%,  $p<0.01$ ). **CONCLUSION:** The high prevalence of emotional and behavioral problems indicates that screening for psychopathology should be a part of multidisciplinary follow-up of CP. The CBCL can be used as a screening instrument in children with CP without severe motor and cognitive disability.

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PMID: 26707927 [PubMed - in process]

# Qualité de vie et rapport au monde

## +Qualité de vie

### **Do environmental barriers affect the parent-reported quality of life of children and adolescents with cerebral palsy?**

Badia M, Begoña Orgaz M, Gómez-Vela M, Verdugo MA, Ullán AM, Longo E.

*Res Dev Disabil.* 2016 Feb-Mar;49-50:312-21. doi: 10.1016/j.ridd.2015.12.011. Epub 2016 Jan 11.

Physical, social, and attitudinal environment may affect the quality of life (QoL) of children and adolescents with cerebral palsy (CP). Participants in this study included parents of 206 children and adolescents with CP (55.8% males) aged 8-18 years (M=11.96, SD=3). Distribution according to the Gross Motor Function Classification System (GMFCS) was 24.3% level I, 18% level II, 18% level III, 12.6% level IV, and 27.2 level V. Environmental barriers were assessed with the Spanish version of the European Child Environment Questionnaire (ECEQ), and QoL was assessed with the KIDSCREEN parents' version. The results of the correlation analysis revealed that GMFCS level, IQ, and type of schooling are significantly correlated with QoL. Barriers were also associated with QoL. A series of hierarchical regression analyses indicated that, after controlling for the effect of child and parent's variables, barriers at home and at school significantly contribute to QoL. These findings underscore the importance of providing interventions to produce environmental changes that contribute to the improvement of QoL.

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PMID: 26788697 [PubMed - in process]

### **Health-Related Quality of Life in Children and Adolescents with Cerebral Palsy: A Secondary Analysis of the DISABKIDS Questionnaire in the Field-Study Cerebral Palsy Subgroup.**

Mueller-Godeffroy E, Thyen U, Bullinger M.

*Neuropediatrics.* 2016 Feb 15. [Epub ahead of print]

**Introduction** Health-related quality of life (HRQOL) instruments are increasingly being used to evaluate interventions and therapy outcomes in children and adolescents with cerebral palsy (CP). A variety of psychometrically sound and validated generic and disease-specific instruments are available. A third type of instrument, the chronic-generic instrument, pertains to features of HRQOL that are shared by various chronic conditions. The DISABKIDS family of questionnaires consists of a chronic-generic core measure (DCGM-37) and several condition-specific modules, among these, a CP module (CPM). The objective of this article was to describe the performance and, specifically, the validity of the DCGM-37 and CPM in children and adolescents with CP.

**Methods** Psychometric properties of the DCGM-37 and the CPM are presented. The discriminant validity was assessed compared with generic measures of HRQOL regarding different levels of impairment (physical independence; developmental delay).

**Results** A total of 86 patients with CP (mean age 13 years, range 7-19 years) and 78 main caretakers participated in this study. The DCGM-37 and CPM showed much better discriminative ability as compared with generic questionnaires.

**Conclusions** The DCGM-37 and CPM were able to differentiate between patients with different levels of impairment and can be recommended for treatment evaluation and group comparison in clinical studies of children and adolescents with CP.

Georg Thieme Verlag KG Stuttgart · New York.

PMID: 26878168 [PubMed - as supplied by publisher]

## +Retentissement dans la vie quotidienne

### **Change in residential remoteness during the first 5 years of life in an Australian cerebral palsy cohort.**

DeLacy MJ, Louca C, Smithers-Sheedy H, McIntyre S; Australian Cerebral Palsy Register Group.

*Dev Med Child Neurol.* 2016 Feb;58 Suppl 2:60-5. doi: 10.1111/dmcn.13013. Epub 2016 Jan 14.

**AIM:** To determine if families of children with cerebral palsy living in Australia move to less remote areas between birth and 5 years.

**METHOD:** Children on the Australian Cerebral Palsy Register (n=3399) born 1996 to 2005, were assigned a remoteness value for family residence at birth and 5 years using a modification of the Australian Statistical

Geography Standard. Each value at birth was subtracted from the value at 5 years yielding a positive difference if they moved more remotely, negative difference if they moved less remotely and a value of zero if they did not move or moved to an equally remote residence. non-significant ( $p=0.43$ ). Fifty-seven per cent of families changed postcode but only 20% changed remoteness, 11% more remotely, and 9% less remotely. There was a small trend for families with a child with more impaired gross motor function (Gross Motor Function Classification System levels IV and V) to move to a less

RESULTS: The small net increase in remoteness across this cohort was remote area.

INTERPRETATION: This cohort of families with children with cerebral palsy did not appear to move to less remote areas by age 5 years. Remoteness at birth and level of gross motor function seem to have little effect.

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### **Differences in autonomic functions as related to induced stress between children with and without cerebral palsy while performing a virtual meal-making task.**

Kirshner S, Weiss PL, Tirosh E.

*Res Dev Disabil.* 2016 Feb-Mar;49-50:247-57. doi: 10.1016/j.ridd.2015.11.025. Epub 2015 Dec 29.

BACKGROUND: Efforts to improve the participation and performance of children with cerebral palsy (CP) are often related to the adaptation of environmental conditions to meet their cognitive and motor abilities. However, the influence of affective stimuli within the environment on emotion and performance, and their ability to improve or impede the children's participation has not been investigated in any systematic way although the emerging evidence suggests that it affects the individuals in many levels.

OBJECTIVES: (1) To measure autonomic responses to affective stimuli during a simulated Meal-Maker task in children with CP in comparison to children who are typically developing, and (2) to examine the interactions between autonomic functions, subjective reports of stress, and task performance among children with and without CP.

METHODS: Fifteen children with CP and 19 typically developing peers (6 to 12 years) participated. After completing behavioral questionnaires (e.g., State and Trait Anxiety Inventories), children prepared meals within a camera tracking virtual Meal-Maker environment. Either a negative, positive, or neutral visual stimulus was displayed, selected from the International Affective Picture System. Children also passively viewed the same pictures while rating their valence and arousal levels. Heart rate (HR) and skin conductance were recorded synchronously with stimulus onset.

RESULTS: Significant differences in autonomic functions were found between groups, i.e., a higher "low frequency" to "high frequency" (LF:HF) ratio in the children with CP during the meals associated with a negative stimulus ( $p=0.011$ ). Only children with CP had significant positive correlations between trait anxiety and LF:HF ratio during virtual meal-making associated with positive ( $p=0.049$ ) and negative stimuli ( $p=0.003$ ) but not during neutral stimuli. For children with CP the amplitude of skin conductance response during passive picture viewing was significantly higher for negative than for positive stimuli ( $p=0.017$ ) but there were no significant changes in autonomic responses during virtual Meal-Maker task. Significant correlations between trait anxiety, autonomic activity during the calm state and Meal-Maker performance outcomes were found only for children with CP.

CONCLUSIONS: In general, the Meal-Maker virtual environment was shown to be a feasible platform for the investigation of the effect of emotionally loaded stimuli on the balance of autonomic functions in children with and without CP. Anxiety level appears to play a significant role in children with CP and should be considered as a potentially important factor during clinical evaluation and intervention. Further studies are needed to develop additional measurements of emotional responses and to refine the types of affective interference.

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PMID: 26735708 [PubMed - in process]

## **Activité physique - Sport**

### **Barriers and facilitators to participation in physical activity: The experiences of a group of South African adolescents with cerebral palsy.**

Conchar L, Bantjes J, Swartz L, Derman W.

*J Health Psychol.* 2016 Feb;21(2):152-63. doi: 10.1177/1359105314523305. Epub 2014 Mar 6.

Participation in regular physical activity promotes physical health and psychosocial well-being. Interventions are thus needed to promote physical activity, particularly among groups of individuals, such as persons with disability, who are marginalised from physical activity. This study explored the experiences of a group of South African adolescents with cerebral palsy. In-depth semi-structured interviews were conducted with 15 adolescents with cerebral palsy. The results provided insight into a range of factors that promote and hinder participation in physical activity among adolescents with cerebral palsy in resource-scarce environments.

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PMID: 24607923 [PubMed - in process]

### **Benefits and Enjoyment of a Swimming Intervention for Youth With Cerebral Palsy: An RCT Study.**

Declerck M, Verheul M, Daly D, Sanders R.

*Pediatr Phys Ther.* 2016 Feb 11. [Epub ahead of print]

**PURPOSE:** To investigate enjoyment and specific benefits of a swimming intervention for youth with cerebral palsy (CP).

**METHODS:** Fourteen youth with CP (aged 7 to 17 years, Gross Motor Function Classification System levels I to III) were randomly assigned to control and swimming groups. Walking ability, swimming skills, fatigue, and pain were assessed at baseline, after a 10-week swimming intervention (2/week, 40-50 minutes) or control period, after a 5-week follow-up and, for the intervention group, after a 20-week follow-up period. The level of enjoyment of each swim-session was assessed.

**RESULTS:** Levels of enjoyment were high. Walking and swimming skills improved significantly more in the swimming than in the control group ( $P = .043$ ;  $P = .002$ , respectively), whereas fatigue and pain did not increase. After 20 weeks, gains in walking and swimming skills were retained ( $P = .017$ ;  $P = .016$ , respectively).

**CONCLUSION:** We recommend a swimming program for youth with CP to complement a physical therapy program.

PMID: 26871379 [PubMed - as supplied by publisher]

### **Consensus Planning Toward a Community-Based Approach to Promote Physical Activity in Youth with Cerebral Palsy.**

Gorter JW, Galuppi BE, Gulko R, Wright M, Godkin E.

*Phys Occup Ther Pediatr.* 2016 Feb 11:1-16. [Epub ahead of print]

**AIMS:** To engage researchers and knowledge-users in six Ontario communities in knowledge translation initiatives to identify community-informed elements to guide the development of an optimal physical activity program for youth with cerebral palsy (CP) and to support research efforts.

**METHODS:** The project included three iterative steps, i.e., an environmental scan of five communities, six regional planning meetings, and a member-checking survey, followed by a Delphi survey to reach consensus on the elements deemed most important.

**RESULTS:** Twenty-four elements were identified to include in programs promoting physical activity in youth with CP, which were organized in five categories: raise awareness of the options and opportunities ( $n = 4$ ); pique interest and motivate youth to become and stay active ( $n = 9$ ); ensure community programs are ready for youth with a disability ( $n = 2$ ); be fit, fit in, and finding the best fit ( $n = 5$ ); and explore the layers of physical activity and how they interact ( $n = 4$ ).

**CONCLUSIONS:** The 24 elements established characterize the key concepts that families and community stakeholders value when developing physical activity programs for youth with CP. When incorporated into clinical practice, each of the elements may be used to evaluate key aspects of outcome for individuals with CP.

PMID: 26865106 [PubMed - as supplied by publisher]

### **Exercise and physical activity recommendations for people with cerebral palsy.**

Verschuren O, Peterson MD, Balemans AC, Hurvitz EA.

*Dev Med Child Neurol.* 2016 Feb 7. doi: 10.1111/dmcn.13053. [Epub ahead of print]

Physical activity and its promotion, as well as the avoidance of sedentary behaviour, play important roles in health promotion and prevention of lifestyle-related diseases. Guidelines for young people and adults with typical development are available from the World Health Organisation and American College of Sports Medicine. However, detailed recommendations for physical activity and sedentary behaviour have not been established for children, adolescents, and adults with cerebral palsy (CP). This paper presents the first CP-specific physical activity and

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exercise recommendations. The recommendations are based on (1) a comprehensive review and analysis of the literature, (2) expert opinion, and (3) extensive clinical experience. The evidence supporting these recommendations is based on randomized controlled trials and observational studies involving children, adolescents, and adults with CP, and buttressed by the previous guidelines for the general population. These recommendations may be used to guide healthcare providers on exercise and daily physical activity prescription for individuals with CP.

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### **Risk of Injuries in Paralympic Track and Field Differs by Impairment and Event Discipline: A Prospective Cohort Study at the London 2012 Paralympic Games.**

Blauwet CA, Cushman D, Emery C, Willick SE, Webborn N, Derman W, Schwellnus M, Stomphorst J, Van de Vliet P.

*Am J Sports Med.* 2016 Feb 26. pii: 0363546516629949. [Epub ahead of print]

**BACKGROUND:** The incidence rates (IRs) and factors associated with injuries in the sport of Paralympic athletics (track and field) have not been comprehensively and prospectively studied.

**PURPOSE:** To determine injury IRs, characteristics of injuries, and associated factors in the sport of athletics at the London 2012 Paralympic Games.

**STUDY DESIGN:** Cohort study; Level of evidence, 2.

**METHODS:** A total of 977 athletes competing in the sport of athletics were followed over a total 10-day competition period of the Paralympic Games. Daily injury data were obtained via 2 databases: (1) a custom-built, web-based injury and illness surveillance system (WEB-IISS), maintained by team medical personnel; and (2) the organizing committee database, maintained by medical providers in the medical stations operated by the London Organising Committee of the Olympic and Paralympic Games. Athlete impairment and event discipline were obtained via the International Paralympic Committee athlete database. IRs (injuries per 1000 athlete-days) by impairment, event discipline, sex, and age were examined.

**RESULTS:** The overall IR was 22.1 injuries per 1000 athlete-days (95% CI, 19.5-24.7). In track disciplines, ambulant athletes with cerebral palsy experienced a lower incidence of injuries (IR, 10.2; 95% CI, 4.2-16.2) when compared with ambulant athletes from other impairment categories. Athletes in seated throwing experienced a higher incidence of injuries (IR, 23.7; 95% CI, 17.5-30.0) when compared with athletes in wheelchair racing (IR, 10.6; 95% CI, 5.5-15.6). In both track and field disciplines, the majority of injuries did not result in time loss from competition or training. Ambulant athletes experienced the greatest proportion of injuries to the thigh (16.4% of all injuries; IR, 4.0), observed predominantly in track athletes. Wheelchair or seated athletes experienced the greatest proportion of injuries to the shoulder/clavicle (19.3% of all injuries; IR, 3.4), observed predominantly in field athletes.

**CONCLUSION:** This is the first prospective cohort study examining injury IRs and associated factors in the sport of athletics at the Paralympic Games. Injury patterns were specific to the event discipline and athlete impairment. The majority of injuries occurred to the thigh (ambulant athletes) or shoulder/clavicle (wheelchair or seated athletes) and did not result in time loss.

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PMID: 26920432 [PubMed - as supplied by publisher]

## **Accompagnement**

### **Determinants of participation in family and recreational activities of young children with cerebral palsy.**

Chiarello LA, Bartlett DJ, Palisano RJ, McCoy SW, Fiss AL, Jeffries L, Wilk P.

*Disabil Rehabil.* 2016 Feb 15:1-14. [Epub ahead of print]

**Purpose** To test a model of child, family and service determinants of participation in family and recreational activities for young children with cerebral palsy (CP).

**Methods** Participants were a convenience sample of 429

children (242 males) with CP, aged 18 to 60 months, representing all levels of the Gross Motor Function Classification System (GMFCS). Children were divided into two groups by GMFCS levels, levels I to II and levels III to V. Data on impairments and gross motor function were collected by therapists; parents provided information about children's health conditions and adaptive behaviour. Seven months later, parents reported on family life and services received. One year after the beginning of the study, parents reported their children's participation. Data from the two groups of children were analysed separately using structural equation modelling.

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Results The model explained 35% and 40% of the variance of frequency of participation in family and recreation and 28% and 38% of enjoyment in participation, for the two groups of children, respectively. Children's adaptive behaviour, family ecology, and number of community recreational programs were associated with the frequency of participation for both groups. Gross motor function was only associated with the frequency of participation for children in levels III-V. Adaptive behaviour was associated with enjoyment for both groups. The extent services met children's needs was associated with enjoyment for children in levels I to II and family ecology was a determinant of enjoyment for children in levels III to V.

Conclusion Supporting children's adaptive behaviour, family ecology, and access to community recreational programmes may foster participation in family and recreational activities for young children with CP. Implications for Rehabilitation Participation in family and recreational activities for young children with CP is complex and influenced by child, family and environmental factors. Practitioners are encouraged to support children's adaptive behaviour and access to community programs and family relationships, involvement in community activities and expectations of their children. Optimizing gross motor function for children who have limitations in self-mobility may enhance their participation in family and recreational activities. For children with a good prognosis for walking, providing services perceived by parents to meet their children's needs may enhance children's enjoyment of participation.

PMID: 26878416 [PubMed - as supplied by publisher]

### **Family quality of life among families with a child who has a severe neurodevelopmental disability: Impact of family and child socio-demographic factors.**

Schertz M, Karni-Visel Y, Tamir A, Genizi J, Roth D.

*Res Dev Disabil.* 2016 Feb 9;53-54:95-106. doi: 10.1016/j.ridd.2015.11.028. [Epub ahead of print]

We aimed to examine family quality of life (FQOL) of Northern Israeli families having a child with a severe neurodevelopmental disability and its relation to socio-demographics. The cohort included caregivers of 70 children ages (mean±standard deviation) 5.36±3.53 years. Families were two-parent (85.7%), lived in the periphery (67.1%) and included Jews (60%), Muslims (18.6%), Druze (14.3%) and Christians (7.1%). Religiosity included: secular (38.6%), traditional (31.4%), religious (30%). Children's diagnosis included autistic spectrum disorder (41.4%), intellectual disability (21.4%), cerebral palsy (17.1%), genetic syndromes (17.1%) and sensorineural hearing loss (2.9%). Degree of support (1-minimal,5-greatest) required by the child was 3.67±1.28 for physical and 3.49±1.36 for communication. Primary caregivers completed the FQOL Survey. Domain scores were highest for family relations and lowest for financial well-being. Dimension scores were highest for importance and lowest for opportunities. Overall FQOL approximated average. Jewish families and residents of a major urban area reported higher and more religious families reported lower overall FQOL. Regression analysis found ethnicity contributing to overall FQOL and domain scores with residence contributing to support from services. Ethnicity and child dependence contributed to dimension scores. Northern Israeli families having a child with a severe neurodevelopmental disability report average FQOL scores. However, family and child dependence characteristics affect FQOL scores. Professionals working with these families should consider FQOL information when making recommendations.

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PMID: 26871463 [PubMed - as supplied by publisher]

## Domotique - Nouvelles technologies

### **Single-Trial Analysis of Inter-Beat Interval Perturbations Accompanying Single-Switch Scanning: Case Series of Three Children With Severe Spastic Quadriplegic Cerebral Palsy.**

Leung B, Chau T.

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Single-switch access in conjunction with scanning remains a fundamental solution in restoring communication for many children with profound physical disabilities. However, untimely switch inaction and unintentional switch activations can lead to user frustration and impede functional communication. A previous preliminary study, in the context of a case series with three single-switch users, reported that correct, accidental and missed switch activations could elicit cardiac deceleration and increased phasic skin conductance on average, while deliberate switch non-use was associated with autonomic nonresponse. The present study investigated the possibility of using

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blood volume pulse recordings from the same three pediatric single-switch users to track the aforementioned switch events on a single-trial basis. Peaks of the line length time series derived from the empirical mode decomposition of the inter-beat interval time series matched, on average, a high percentage (above 80%) of single-switch events, while unmatched peaks coincided moderately (below 37%) with idle time during scanning. These results encourage further study of autonomic measures as complementary information channels to enhance single-switch access.

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