

Science Infos

Paralysie Cérébrale



LA FONDATION
MOTRICE
RECHERCHE SUR LA
PARALYSIE CÉRÉBRALE

N°21- MARS 2016

Focus

La Fondation Motrice vient de nommer son nouveau Conseil Scientifique.

Le Conseil scientifique, composé de 12 membres donne son avis sur les grandes orientations de la Fondation et les appels à projets.

Président

Pr Olivier Baud, Neuropédiatre, Néonatalogiste, Spécialiste de la neuroprotection du cerveau en développement, Hôpital Robert Debré, Paris,

Représentant des familles

Mr Eric Bérard, Commission éthique et Représentant des Parents du bureau de la Fédération Française des Associations d'IMC, Lyon

Dr Valérie Achache, Kinésithérapeute et Ingénieur, Responsable du laboratoire d'analyse de la marche, Hôpital de Saint Maurice,

Dr Stéphane Armand, Chef de groupe, Service de chirurgie orthopédique et traumatologique de l'appareil moteur, Laboratoire de cinésiologie Willy Taillard, Hôpitaux Universitaires de Genève,

Dr Sylvain Brochard, Médecin de Médecine Physique et Réadaptation pédiatrique, Spécialiste des complications orthopédiques et de prévention de la douleur, CHU Morvan, Brest,

Dr Ghislaine Dehaene, Neuropédiatre, Spécialiste du développement cognitif de l'enfant et d'imagerie cérébrale, Neurospin, CEA, Orsay,

Dr Joël Fluss, Neuropédiatre, Spécialiste du neurodéveloppement et des conséquences des lésions cérébrales sur les facultés cognitives, Hôpitaux Universitaires de Genève,

Pr Jean Michel Gracies, Médecin de Médecine Physique Réadaptation adulte, Neurophysiologiste, Spécialiste de la neuro-rééducation du mouvement, CHIC de Créteil,

Dr Javier de La Cruz, Médecin épidemiologiste, Ancien coordinateur du réseau des registres SPCE, Hospital Universitario 12 de Octubre, Madrid,

Pr Patricia Limousin, Neurologue, Spécialiste de la stimulation cérébrale profonde, University College London, Londres

Pr Jean-Pierre Lin, Neuropédiatre, Complex Motor Disorders Service, Evelina London Children's Hospital, Guy's & St Thomas', Londres

Dr Anita Truttmann, Pédiatre, Néonatalogiste, Département médico-chirurgical de pédiatrie/néonatalogie, CHUV Lausanne .

Sommaire

Manifestations et congrès Publications scientifiques

Cerebral palsy research funding from the National Institutes of Health, 2001 to 2013.

Epidémiologie

•Prévalence- Incidence

Prediction of Neurodevelopmental Outcome of Preterm Babies Using Risk Stratification Score.
Outcome of Cerebellar Injury with Intraventricular Hemorrhage.

•Facteurs de risque – Causes

Association between antibiotic prescribing in pregnancy and cerebral palsy or epilepsy in children born at term: a cohort study using the health improvement network.
Neurological sequelae of healthcare-associated sepsis in very-low-birthweight infants: Umbrella review and evidence-based outcome tree.
Prediction of Neurodevelopmental Outcome of Preterm Babies Using Risk Stratification Score.
Risk factors for cerebral palsy in PPRM and preterm delivery with intact membranes.
Risk of neurodevelopmental impairment for outborn extremely preterm infants in an Australian regional network.

•Génétique

De Novo Mutations in Patients with Ataxic CP.
Monoamine neurotransmitter disorders--clinical advances and future perspectives.
Whole-exome sequencing points to considerable genetic heterogeneity of cerebral palsy.

Lésions Prévention des lésions

•Données fondamentales

AMPA-Kainate Receptor Inhibition Promotes Neurologic Recovery in Premature Rabbits with Intraventricular Hemorrhage.
Broccoli sprout supplementation during pregnancy prevents brain injury in the newborn rat following placental insufficiency.
Immunoreactivity of neurogenic factor in the guinea pig brain after prenatal hypoxia.
Microglial migration and interactions with dendrimer nanoparticles are altered in the presence of neuroinflammation.
Peptidylarginine Deiminases as Drug Targets in Neonatal Hypoxic-Ischemic Encephalopathy.
Role of sex steroids and their receptors in human preterm infants: Impacts on future treatment strategies for cerebral development.
Syngeneic transplantation of newborn splenocytes in a murine model of neonatal ischemia-reperfusion brain injury.
Time dependent impact of perinatal hypoxia on growth hormone, insulin-like growth factor 1 and insulin-like growth factor binding protein-3.
Whole-Brain DTI Assessment of White Matter Damage in Children with Bilateral Cerebral Palsy: Evidence of Involvement beyond the Primary Target of the Anoxic Insult.

•Données cliniques

Barriers and enablers to implementing antenatal magnesium sulphate for fetal neuroprotection guidelines: a study using the theoretical domains framework.

Comparison of psychomotor outcome in patients with perinatal asphyxia with versus without therapeutic hypothermia at 4 years using the Ages and Stages Questionnaire screening tool.

MRI and Motor Outcomes in Children with Cerebral Palsy.

Nonreceipt of antenatal magnesium sulphate for fetal neuroprotection at the Women's and Children's Hospital, Adelaide 2010-2013.

Détection – Diagnostic

•Données cliniques

Fidgety movements - tiny in appearance, but huge in impact.

Predictors for early diagnosis of cerebral palsy from national registry data.

Serial 1- and 2-Dimensional Cerebral MRI Measurements in Full-Term Infants after Perinatal Asphyxia.

Motricité - Mobilité – Posture

A Descriptive Study of Lower Limb Torsional Kinematic Profiles in Children With Spastic Diplegia.

A descriptive analysis of the upper limb patterns during gait in individuals with cerebral palsy.

Assessment of net knee moment-angle characteristics by instrumented hand-held dynamometry in children with spastic cerebral palsy and typically developing children.

Classification of gait disorders following traumatic brain injury.

Clinical tools designed to assess motor abilities in children with cerebral palsy.

Coactivation During Dynamometry Testing in Adolescents With Spastic Cerebral Palsy.

Functional classifications for cerebral palsy: correlations between the gross motor function classification system (GMFCS), the manual ability classification system (MACS) and the communication function classification system (CFCSS).

Gait pattern recognition in cerebral palsy patients using neural network modelling.

Longitudinal development of hand function in children with unilateral spastic cerebral palsy aged 18 months to 12 years.

Motion analysis of the upper extremity in children with unilateral cerebral palsy--an assessment of six daily tasks.

Multilevel Upper Body Movement Control during Gait in Children with Cerebral Palsy.

Quadriceps femoris spasticity in children with cerebral palsy: measurement with the pendulum test and relationship with gait abnormalities.

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

Repeatability of muscle synergies within and between days for typically developing children and children with cerebral palsy.

The role of altered proximal femoral geometry in impaired pelvis stability and hip control during CP gait: A simulation study.

The Sarah evaluation scale for children and adolescents with cerebral palsy: description and results.

Thorax and pelvis kinematics during walking, a comparison between children with and without cerebral palsy: A systematic review. 29

Use of sensory information during postural control in children with cerebral palsy: systematic review.

Using a goal attainment scale in the evaluation of outcomes in patients with diplegic cerebral palsy.

Variation in kinematic and spatiotemporal gait parameters by Gross Motor Function Classification System level in children and adolescents with cerebral palsy.

Cognition

Effects of self-control and instructor-control feedback on motor learning in individuals with cerebral palsy.

Traitement - Rééducation motrice et cognitive

Pharmacologie Efficacite Tolérance

A clinically relevant BTX-A injection protocol leads to persistent weakness, contractile material loss, and an altered mRNA expression phenotype in rabbit quadriceps muscles.

Botulinum Toxin Treatment for Limb Spasticity in Childhood Cerebral Palsy.

Evaluation of group versus individual physiotherapy following lower limb intra-muscular Botulinum Toxin-Type A injections for ambulant children with cerebral palsy: A single-blind randomized comparison trial.

Quantitative evaluation for spasticity of calf muscle after botulinum toxin injection in patients with cerebral palsy: a pilot study.

The effect of intrathecal baclofen treatment on activities of daily life in children and young adults with cerebral palsy and progressive neurological disorders.

Chirurgie

Changes in hip geometry after selective dorsal rhizotomy in children with cerebral palsy.

Does rectus femoris transfer increase knee flexion during stance phase in Cerebral palsy?

Inter-observer and intra-observer reliability in the radiographic diagnosis of avascular necrosis of the femoral head following reconstructive hip surgery in children with cerebral palsy.

Long-Term Results of Bilateral Medial Rectus Muscle Recession in Children with Developmental Delay.

Nerve endings and vascular supply in semitendinosus tendon of cerebral palsy Children.

The results of surgical treatment for pronation deformities of the forearm in cerebral palsy after a mean follow-up of 17.5 years.

The split anterior tibialis tendon transfer procedure for spastic equinovarus foot in children with cerebral palsy: results and factors associated with a failed outcome.

Réadaptation fonctionnelle

Biomechanical and perceived differences between overground and treadmill walking in children with cerebral palsy.

Effect of combining passive muscle stretching and whole body vibration on spasticity and physical performance of children and adolescents with cerebral palsy.

Effects of whole-body vibration training on physical function, bone and muscle mass in adolescents and young adults with cerebral palsy.

Gaze-based assistive technology in daily activities in children with severe physical impairments-An intervention study.

Gait Training and Ankle Dorsiflexors in Cerebral Palsy.

Mastery motivation: a way of understanding therapy outcomes for children with unilateral cerebral palsy.

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

Treadmill Training with Virtual Reality Improves Gait, Balance, and Muscle Strength in Children with Cerebral Palsy.

Rehabilitation and neuroplasticity in children with unilateral cerebral palsy.

Stimulation cérébrale - Stimulation neurosensorielle

Cerebellar transcranial direct current stimulation in children with ataxic cerebral palsy: A sham-controlled, crossover, pilot study.

Deep anterior cerebellar stimulation reduces symptoms of secondary dystonia in patients with cerebral palsy treated due to spasticity.

Effect of r-TMS over standard therapy in decreasing muscle tone of spastic cerebral palsy patients.

Transcranial direct current stimulation during treadmill training in children with cerebral palsy: a randomized controlled double-blind clinical trial.

Réalité virtuelle - Jeux video

Preparing a neuropediatric upper limb exergame rehabilitation system for home-use: a feasibility study.

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

Treadmill Training with Virtual Reality Improves Gait, Balance, and Muscle Strength in Children with Cerebral Palsy.

Wrist range of motion and motion frequency during toy and game play with a joint-specific controller specially designed to provide neuromuscular therapy: A proof of concept study in typically developing children.

Thérapie cellulaire Médecine régénérative

Effect of umbilical cord mesenchymal stromal cells on motor functions of identical twins with cerebral palsy: pilot study on the correlation of efficacy and hereditary factors.

Intrathecal injection of CD133-positive enriched bone marrow progenitor cells in children with cerebral palsy: feasibility and safety.

Stem cells therapy in cerebral palsy: A systematic review.

Therapeutic potential of human embryonic stem cell transplantation in patients with cerebral palsy.

Unmasking the responses of the stem cells and progenitors in the subventricular zone after neonatal and pediatric brain injuries.

Exosquelette

Custom sizing of lower limb exoskeleton actuators using gait dynamic modelling of children with cerebral palsy.

Autres methodes

Effect of Hippotherapy on Motor Proficiency and Function in Children with Cerebral Palsy Who Walk.

Douleur

Epidural Baclofen for the Management of Postoperative Pain in Children With Cerebral Palsy.

Fatigue

Focus on fatigue amongst young adults with spastic cerebral palsy.

Langage -parole-communication

Does early communication mediate the relationship between motor ability and social function in children with cerebral palsy?

Sommeil

Obstructive sleep apnea in children: update on the recognition, treatment and management of persistent disease.

Obstructive sleep apnea in children with cerebral palsy and epilepsy.

Autres Troubles /troubles concomitants

✚ •Troubles respiratoires

Change in Pulmonary Function after Incentive Spirometer Exercise in Children with Spastic Cerebral Palsy: A Randomized Controlled Study.

Community-Acquired Pneumonia Hospitalization among Children with Neurologic Disorders.

✚ •Gastroenterologie

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

✚ •Sphère bucco-dentaire

Impact of oral diseases and disorders on oral-health-related quality of life of children with cerebral palsy.

The effect of oral sensorimotor stimulations on feeding performance in children with spastic cerebral palsy.

• **Troubles de la vision**

Comparative Study of Refractive Errors, Strabismus, Microsaccades, and Visual Perception Between Preterm and Full-Term Children With Infantile Cerebral Palsy.

• **Neuropsychologie – Comportement**

Recent Advances in the Neuroimaging and Neuropsychology of Cerebral Palsy.

• **Troubles de la croissance**

Growth during infancy and early childhood in children with cerebral palsy: a population-based study.

Qualité de vie et rapport au monde

• **Activité physique - Sport**

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**

An evaluation of psychometric properties of caregiver burden outcome measures used in caregivers of children with cerebral palsy: a systematic review protocol.

Factors associated with caregiver experience in families with a child with cerebral palsy.

Fatigue in the mothers of children with cerebral palsy.

Higher Levels of Caregiver Strain Perceived by Indian Mothers of Children and Young Adults with Cerebral Palsy Who have Limited Self-Mobility.

Impact of child and family characteristics on cerebral palsy treatment.

Informal caregivers of clients with neurological conditions: profiles, patterns and risk factors for distress from a home care prevalence study.

Parents' experiences and needs regarding physical and occupational therapy for their young children with cerebral palsy.

Predictors of caregiver depression and family functioning after perinatal stroke.

• **Domotique - Nouvelles technologies – Matériel médical**

Adaptive seating systems in children with severe cerebral palsy across International Classification of Functioning, Disability and Health for Children and Youth version domains: a systematic review.

Performing mathematics activities with non-standard units of measurement using robots controlled via speech-generating devices: three case studies.

• **Impacts socio-économiques**

Development and implementation of microsimulation models of neurological conditions. 57

Sociometric status and the attribution of intentions in a sample of adolescents with cerebral palsy. 58

The heterogeneity in financial and time burden of caregiving to children with chronic conditions. 58

Manifestations et congrès

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

1-4 Juin 2016

Suède, Stockholm

<http://eacd2016.org/>

Septembre 2016

European Paediatric Stroke Symposium 2016

Neonatal Arterial Ischemic Stroke (NAIS) From birth to childhood

21-22 septembre 2016

Saint Etienne, France

<http://www.repar.veille.gq.ca/fichier.php/106/Programme+Congres+AVC+enfantv2+%28français%29.pdf>

6th International Conference on Clinical Neonatology

22-24 Septembre 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 research funding from the National Institutes of Health, 2001 to 2013.

Wu YW, Mehravari AS, Numis AL, Gross P.

Dev Med Child Neurol. 2015 Oct;57(10):936-41. doi: 10.1111/dmcn.12789. Epub 2015 May 6.

Comment in *Dev Med Child Neurol.* 2015 Oct;57(10):892-3.

AIM: Cerebral palsy (CP) is a poorly understood disorder with no cure. We determined the landscape of National Institutes of Health (NIH) funding for CP-related research.

METHOD: We searched NIH databases Research Portfolio Online Reporting Tools Expenditures and Results, and Research, Condition, and Disease Categorization for keywords 'cerebral palsy' among all NIH-funded studies, 2001 to 2013. We classified grants by type and area of study.

RESULTS: NIH funding, averaging \$30 million per year, supported clinical (\$215 million), basic (\$187 million), and translational (\$26.3 million) CP-related research. Clinical intervention studies comprised 19% of funding, and focused on treatments (\$60.3 million), early parent intervention (\$2.7 million), and CP prevention (\$2.5 million). Among grants that specified gestational age, more funds were devoted to preterm (\$166 million) than term infants (\$15 million). CP in adulthood was the main focus of 4% of all funding. Annual NIH funding for CP increased steadily over the study period from \$3.6 to \$66.7 million. However, funding for clinical intervention studies peaked in 2008, and has since decreased.

INTERPRETATION: Additional research funds are needed to improve the treatment and prevention of CP. Topics that have been relatively underfunded include clinical interventions, prevention, and term infants and adults with CP.

© 2015 Mac Keith Press.

PMID: 25951080 [PubMed - indexed for MEDLINE]

Epidémiologie

Prévalence- Incidence

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

Sujatha R, Jain N.

Indian J Pediatr. 2016 Feb 26

OBJECTIVES: To study the incidence of major neurodevelopmental disability (NDD) at 1 y age (corrected for prematurity) in a cohort of preterm Indian babies (≤ 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 ≤ 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 ≤ 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]

Outcome of Cerebellar Injury with Intraventricular Hemorrhage.

Venkatesan C.

Pediatr Neurol Briefs. 2015 Feb;29(2):12. doi: 10.15844/pedneurbriefs-29-2-3.

Investigators from the Department of Pediatric Neurology, Morinomiya Hospital, Osaka, Japan performed a retrospective IRB approved study of the prevalence of cerebellar injury (CI) and effect on functional outcomes among preterm children with intraventricular hemorrhage (IVH) and cerebral palsy (CP), comparing them to infants with post-hemorrhagic hydrocephalus (PH).

[Free PMC Article](#)

PMCID: PMC4747287

PMID: 26933555 [PubMed]

Facteurs de risque – Causes

Association between antibiotic prescribing in pregnancy and cerebral palsy or epilepsy in children born at term: a cohort study using the health improvement network.

Meeraus WH, Petersen I, Gilbert R.

PLoS One. 2015 Mar 25;10(3):e0122034. doi: 10.1371/journal.pone.0122034. eCollection 2015.

BACKGROUND: Between 19%-44% pregnant women are prescribed antibiotics during pregnancy. A single, large randomised-controlled-trial (ORACLE Childhood Study II) found an increased risk of childhood cerebral palsy and possibly epilepsy following prophylactic antibiotic use in pregnant women with spontaneous preterm labour. We ascertained whether this outcome could be reproduced across the population of babies delivered at term and prospectively followed in primary-care using data from The Health Improvement Network.

METHODS: We determined the risk of cerebral palsy or epilepsy in children whose mothers were prescribed antibiotics during pregnancy using a cohort of 195,909 women linked to their live, term-born, singleton children. We compared the effect of antibiotic class, number of courses and timing of prescribing in pregnancy. Analyses were adjusted for maternal risk factors (e.g. recorded infection, age, chronic conditions, social deprivation, smoking status). Children were followed until age seven years or cessation of registration with the primary-care practitioner.

RESULTS: In total, 64,623 (33.0%) women were prescribed antibiotics in pregnancy and 1,170 (0.60%) children had records indicating cerebral palsy or epilepsy. Adjusted analyses showed no association between prescribing of any antibiotic and cerebral palsy or epilepsy (adj.HR 1.04, 95%CI 0.91-1.19). However, compared with penicillins, macrolides were associated with an increased risk of cerebral palsy or epilepsy (adj.HR 1.78, 95%CI 1.18-2.69; number needed to harm 153, 95%CI 71-671).

CONCLUSIONS: We found no overall association between antibiotic prescribing in pregnancy and cerebral palsy and/or epilepsy in childhood. However, our finding of an increased risk of cerebral palsy or epilepsy associated with macrolide prescribing in pregnancy adds to evidence that macrolide use is associated with serious harm.

[Free PMC Article](#)

PMCID: PMC4373729

PMID: 25807115 [PubMed - indexed for MEDLINE]

Neonatology. 2016 Mar 12;110(1):21-26. [Epub ahead of print]

Long-Term Neurodevelopmental Outcome after Doxapram for Apnea of Prematurity.

Ten Hove CH, Vliegthart RJ, Te Pas AB, Brouwer E, Rijken M, van Wassenaer-Leemhuis AG, van Kaam AH, Onland W.

BACKGROUND: Doxapram has been advocated as a treatment for persistent apnea of prematurity (AOP).

OBJECTIVE: To evaluate the effect of doxapram on long-term neurodevelopmental outcome in preterm infants as its safety still needs to be established.

METHODS: From a retrospective cohort of preterm infants with a gestational age (GA) <30 weeks and/or a birth weight <1,250 g, born between 2000 and 2010, infants treated with doxapram (n = 142) and a nontreated control group were selected (n = 284). Patient characteristics and clinical and neurodevelopmental outcome data at 24 months' corrected age were collected. Neurodevelopmental delay (ND) was defined as having a Mental or Psychomotor Developmental Index (MDI/PDI) <-1 standard deviation (SD), cerebral palsy, or a hearing or visual impairment. Odds ratios (OR) were calculated using multiple logistic regression analyses adjusting for potential confounders.

RESULTS: Infants treated with doxapram had a lower GA compared to controls. The number of infants with a MDI or PDI <-1 SD was not different between the groups. The risk of the combined outcome death or ND was significantly lower in the doxapram group after adjusting for confounding factors (OR = 0.54, 95% CI: 0.37, 0.78). Doxapram-treated infants had a higher risk of bronchopulmonary dysplasia and patent ductus arteriosus, but a lower risk of spontaneous intestinal perforation. All other morbidities were not different between the groups.

CONCLUSIONS: This study suggests that doxapram is not associated with an increased risk of ND. These findings need to be confirmed or refuted by a large, well-designed, placebo-controlled randomized trial.

© 2016 S. Karger AG, Basel.

PMID: 26967910 [PubMed - as supplied by publisher]

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, Ducombe 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]

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 (≤ 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 ≤ 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 ≤ 28 wk, need for extensive resuscitation at birth, [Science Infos Paralysie Cérébrale](#), mars 2016, [FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 10 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org](#)

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]

Risk of neurodevelopmental impairment for outborn extremely preterm infants in an Australian regional network.

J Matern Fetal Neonatal Med. 2016 Mar 9:1-25. [Epub ahead of print]

Mahoney K(1), Bajuk B(2), Oei J(3),(4), Lui K(3),(4), Abdel-Latif ME(1),(5);NICUS Network.

OBJECTIVE: To compare neurodevelopmental outcomes at 2-3 years in extremely premature outborn and inborn infants.

DESIGN: Population-based retrospective cohort study.

SETTING: Geographically defined area of New South Wales (NSW) and the Australian Capital Territory (ACT) served by a network of 10 neonatal intensive care units (NICUs).

PATIENTS: All premature infants <29 weeks gestation born between 1998-2004 in the setting.

INTERVENTION: At 2-3 years, corrected age, 1473 children were assessed with either the Griffiths Mental Developmental Scales (GMDS) or the Bayley Scales of Infant Development (BSID-II).

MAIN OUTCOME MEASURE: Moderate/severe functional disability (FD) defined as: developmental delay (GMDS general quotient (GQ) or BSID-II mental developmental index (MDI))>2 standard deviations (SD) below the mean; cerebral palsy (CP) requiring aids; sensorineural or conductive deafness (requiring amplification); or bilateral blindness (visual acuity <6/60 in better eye).

RESULTS: At 2-3 years, moderate/severe functional disability does not appear to be significantly different between outborn and inborn infants (adjusted OR 0.782; 95% CI 0.424-1.443). However, there were a significant number of outborn infants lost to follow up (23.3% vs 42.9%).

CONCLUSION: In this cohort, at 2-3 years follow up neurodevelopmental outcome does not appear to be significantly different between outborn and inborn infants. These results should be interpreted with caution given the limitation of this study.

PMID: 26957041 [PubMed - as supplied by publisher]

De Novo Mutations in Patients with Ataxic CP.

Agarwal S, Emrick L.

Pediatr Neurol Briefs. 2015 Aug;29(8):62. doi: 10.15844/pedneurbriefs-29-8-5.

As a part of a large study investigating childhood ataxias in the UK and Switzerland, Schnekenberg et al. analyzed the genetic associations with congenital cerebellar ataxia in 10 patients using either a targeted next generation sequencing panel of 118 genes or trio-based exome sequencing.

[Free PMC Article](#)

PMCID: PMC4747133

PMID: 26933599 [PubMed]

Monoamine neurotransmitter disorders--clinical advances and future perspectives.

Ng J, Papandreou A, Heales SJ, Kurian MA

Nat Rev Neurol. 2015 Oct;11(10):567-84. doi: 10.1038/nrneurol.2015.172. Epub 2015 Sep 22.

The monoamine neurotransmitter disorders are important genetic syndromes that cause disturbances in catecholamine (dopamine, noradrenaline and adrenaline) and serotonin homeostasis. These disorders result in aberrant monoamine synthesis, metabolism and transport. The clinical phenotypes are predominantly neurological, and symptoms resemble other childhood neurological disorders, such as dystonic or dyskinetic cerebral palsy, hypoxic ischaemic encephalopathy and movement disorders. As a consequence, monoamine neurotransmitter disorders are under-recognized and often misdiagnosed. The diagnosis of monoamine neurotransmitter disorders requires detailed clinical assessment, cerebrospinal fluid neurotransmitter analysis and further supportive diagnostic investigations. Prompt and accurate diagnosis of neurotransmitter disorders is paramount, as many are responsive to treatment. The treatment is usually mechanism-based, with the aim to reverse disturbances of monoamine synthesis and/or metabolism. Therapeutic intervention can lead to complete resolution of motor symptoms in some conditions, and considerably improve quality of life in others. In this Review, we discuss the clinical features, diagnosis and management of monoamine neurotransmitter disorders, and consider novel concepts, the latest advances in research and future prospects for therapy.

PMID: 26392380 [PubMed - indexed for MEDLINE]

Whole-exome sequencing points to considerable genetic heterogeneity of cerebral palsy.

McMichael G, Bainbridge MN, Haan E, Corbett M, Gardner A, Thompson S, van Bon BW, van Eyk CL, Broadbent J, Reynolds C, O'Callaghan ME, Nguyen LS, Adelson DL, Russo R, Jhangiani S, Doddapaneni H, Muzny DM, Gibbs RA, Gecz J, MacLennan AH.

Mol Psychiatry. 2015 Feb;20(2):176-82. doi: 10.1038/mp.2014.189. Epub 2015 Feb 10.

Cerebral palsy (CP) is a common, clinically heterogeneous group of disorders affecting movement and posture. Its prevalence has changed little in 50 years and the causes remain largely unknown. The genetic contribution to CP causation has been predicted to be ~2%. We performed whole-exome sequencing of 183 cases with CP including both parents (98 cases) or one parent (67 cases) and 18 singleton cases (no parental DNA). We identified and validated 61 de novo protein-altering variants in 43 out of 98 (44%) case-parent trios. Initial prioritization of variants for causality was by mutation type, whether they were known or predicted to be deleterious and whether they occurred in known disease genes whose clinical spectrum overlaps CP. Further, prioritization used two multidimensional frameworks-the Residual Variation Intolerance Score and the Combined Annotation-dependent Depletion score. Ten de novo mutations in three previously identified disease genes (TUBA1A (n=2), SCN8A (n=1) and KDM5C (n=1)) and in six novel candidate CP genes (AGAP1, JHDM1D, MAST1, NAA35, RFX2 and WIPI2) were predicted to be potentially pathogenic for CP. In addition, we identified four predicted pathogenic, hemizygous variants on chromosome X in two known disease genes, L1CAM and PAK3, and in two novel candidate CP genes, CD99L2 and TENM1. In total, 14% of CP cases, by strict criteria, had a potentially disease-causing gene variant. Half were in novel genes. The genetic heterogeneity highlights the complexity of the genetic contribution to CP. Function and pathway studies are required to establish the causative role of these putative pathogenic CP genes.

PMID: 25666757 [PubMed - indexed for MEDLINE]

+Données fondamentales

AMPA-Kainate Receptor Inhibition Promotes Neurologic Recovery in Premature Rabbits with Intraventricular Hemorrhage.

Dohare P, Zia MT, Ahmed E, Ahmed A, Yadala V, Schober AL, Ortega JA, Kayton R, Ungvari Z, Mongin AA, Ballabh P
J Neurosci. 2016 Mar 16;36(11):3363-77. doi: 10.1523/JNEUROSCI.4329-15.2016.

Intraventricular hemorrhage (IVH) in preterm infants leads to cerebral inflammation, reduced myelination of the white matter, and neurological deficits. No therapeutic strategy exists against the IVH-induced white matter injury. AMPA-kainate receptor induced excitotoxicity contributes to oligodendrocyte precursor cell (OPC) damage and hypomyelination in both neonatal and adult models of brain injury. Here, we hypothesized that IVH damages white matter via AMPA receptor activation, and that AMPA-kainate receptor inhibition suppresses inflammation and restores OPC maturation, myelination, and neurologic recovery in preterm newborns with IVH. We tested these hypotheses in a rabbit model of glycerol-induced IVH and evaluated the expression of AMPA receptors in autopsy samples from human preterm infants. GluR1-GluR4 expressions were comparable between preterm humans and rabbits with and without IVH. However, GluR1 and GluR2 levels were significantly lower in the embryonic white matter and germinal matrix relative to the neocortex in both infants with and without IVH. Pharmacological blockade of AMPA-kainate receptors with systemic NBQX, or selective AMPA receptor inhibition by intramuscular perampanel restored myelination and neurologic recovery in rabbits with IVH. NBQX administration also reduced the population of apoptotic OPCs, levels of several cytokines (TNF α , IL- β , IL-6, LIF), and the density of Iba1(+) microglia in pups with IVH. Additionally, NBQX treatment inhibited STAT-3 phosphorylation, but not astrogliosis or transcription factors regulating gliosis. Our data suggest that AMPA-kainate receptor inhibition alleviates OPC loss and IVH-induced inflammation and restores myelination and neurologic recovery in preterm rabbits with IVH. Therapeutic use of FDA-approved perampanel treatment might enhance neurologic outcome in premature infants with IVH.

SIGNIFICANCE STATEMENT: Intraventricular hemorrhage (IVH) is a major complication of prematurity and a large number of survivors with IVH develop cerebral palsy and cognitive deficits. The development of IVH leads to inflammation of the periventricular white matter, apoptosis and arrested maturation of oligodendrocyte precursor cells, and hypomyelination. Here, we show that AMPA-kainate receptor inhibition by NBQX suppresses inflammation, attenuates apoptosis of oligodendrocyte precursor cells, and promotes myelination as well as clinical recovery in preterm rabbits with IVH. Importantly, AMPA-specific inhibition by the FDA-approved perampanel, which unlike NBQX has a low side-effect profile, also enhances myelination and neurological recovery in rabbits with IVH. Hence, the present study highlights the role of AMPA-kainate receptor in IVH-induced white matter injury and identifies a novel strategy of neuroprotection, which might improve the neurological outcome for premature infants with IVH.

Copyright © 2016 the authors 0270-6474/16/363364-15\$15.00/0.

PMID: 26985043 [PubMed - in process]

Broccoli sprout supplementation during pregnancy prevents brain injury in the newborn rat following placental insufficiency.

Black AM, Armstrong EA, Scott O, Juurlink BJ, Yager JY.

Behav Brain Res. 2015 Sep 15;291:289-98. doi: 10.1016/j.bbr.2015.05.033. Epub 2015 May 23.

Chronic placental insufficiency and subsequent intrauterine growth restriction (IUGR) increase the risk of hypoxic-ischemic encephalopathy in the newborn by 40 fold. The latter, in turn, increases the risk of cerebral palsy and developmental disabilities. This study seeks to determine the effectiveness of broccoli sprouts (BrSp), a rich source of the isothiocyanate sulforaphane, as a neuroprotectant in a rat model of chronic placental insufficiency and IUGR. Placental insufficiency and IUGR was induced by bilateral uterine artery ligation (BUAL) on day E20 of gestation. Dams were fed standard chow or chow supplemented with 200mg of dried BrSp from E15 - postnatal day 14 (PD14). Controls received Sham surgery and the same dietary regime. Pups underwent neurologic reflex testing and open field testing, following which they were euthanized and their brains frozen for neuropathologic assessment. Compared to Sham, IUGR pups were delayed in attaining early reflexes and performed worse in the open field, both of which were significantly improved by maternal supplementation of BrSp ($p < 0.05$). Neuropathology revealed diminished white

Science Infos Paralysie Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 13 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

matter, ventricular dilation, astrogliosis and reduction in hippocampal neurons in IUGR animals compared to Sham, whereas broccoli sprout supplementation improved outcome in all histological assessments ($p < 0.05$). Maternal dietary supplementation with BrSp prevented the detrimental neurocognitive and neuropathologic effects of chronic intrauterine ischemia. These findings suggest a novel approach for prevention of cerebral palsy and/or developmental disabilities associated with placental insufficiency.

Copyright © 2015 Elsevier B.V. All rights reserved.

PMID: 26014855 [PubMed - indexed for MEDLINE]

Diffusion Tensor Imaging Abnormalities in the Cerebral White Matter Correlate with Sex-Dependent Neurobehavioral Deficits in Adult Mice with Neonatal Ischemia.

Breu M, Zhang J, Porambo M, Pletnikov MV, Goeral K, Kakara M, Johnston MV, Fatemi A.

Dev Neurosci. 2016 Mar 16. [Epub ahead of print]

BACKGROUND: Neonatal white matter injury (NWMI) is the leading cause of cerebral palsy in prematurely born children. In order to develop a test bed for therapeutics, we recently reported a mouse model of NWMI by using a modified Rice-Vannucci model of neonatal ischemia on postnatal day 5 (P5) in CD-1 mice. We have previously shown that these mice illustrate initial neuroinflammation and oligodendroglial differentiation arrest followed by long-term dysmyelination, periventricular astrogliosis and axonal injury, resembling human NWMI. The objective of this study was to determine the sex-dependent long-term effects of neonatal brain injury on neurobehavioral and advanced in vivo neuroimaging indices in this mouse model, and to correlate these variables with histopathology.

METHODS: After right common artery ligation on P5, in vivo T2-weighted imaging and diffusion tensor imaging (DTI) were performed on ligated and control animals at 4 and 8 weeks. Common sets of regions of interest were used to compare fractional anisotropy (FA) values between ischemic and control mice. Behavioral testing (open field, startle response and grip strength) was performed at adult age. Finally, the animals were sacrificed for immunohistochemical (IHC) assessment of major white matter tracts.

RESULTS: DTI revealed significant sex-dependent changes in FA values ipsi- and contralateral to the ligation. Behavioral testing showed decreased reaction to acoustic stimuli in males but not females. Similarly, increased number of rearings and lack of novelty-induced habituation in the open field were encountered only in the male subgroup. Several regional correlations were found between FA values and these behavioral alterations. IHC studies revealed degeneration of mature oligodendrocytes and damage of white matter tracts in ligated animals, as previously reported in this model, and showed regional correlation with in vivo FA values and behavioral alterations.

CONCLUSIONS: Our findings suggest structural sex-dependent long-term abnormalities after neonatal ischemia. These changes lead to behavioral deficits resembling common problems of patients with cerebral palsy.

© 2016 S. Karger AG, Basel.

PMID: 26977597 [PubMed - as supplied by publisher]

Immunoreactivity of neurogenic factor in the guinea pig brain after prenatal hypoxia.

Chung Y, So K, Kim E, Kim S, Jeon Y.

Ann Anat. 2015 Jul;200:66-72. doi: 10.1016/j.aanat.2015.02.003. Epub 2015 Feb 25.

Chronic prenatal hypoxia is considered to cause perinatal brain injury. It can result in neurological disorders such as cerebral palsy or learning disabilities. These neurological problems are related to chronic placental insufficiency (CPI), which leads to chronic hypoxemia and hypoglycemia. The effects of hypoxia on neurogenesis during development have been a matter of controversy. We therefore investigated the effect of chronic prenatal hypoxia in the brain of the fetal guinea pig using the guinea pig CPI model. Chronic placental insufficiency was induced by unilateral uterine artery ligation at 30-32 days of gestation (dg: with term defined as ~67dg). At 50 and 60dg, fetuses were sacrificed and assigned to either the growth-restricted (GR) or control (no ligation) group. Immunohistochemistry was performed with HIF-1 α , PCNA, NeuN and BDNF antibodies in the cerebral cortex and dentate gyrus. The number of NeuN-IR and BDNF-IR cells was lesser in GR fetuses than in controls in the cerebral cortex and dentate gyrus at 60dg ($p < 0.05$). The growth of the developing brain is dependent upon the availability of growth factors such as BDNF. The reduction in the number of neuronal cells observed in our GR group was associated with the observed reduction in BDNF protein found at 60dg. There was no significant difference between control and GR fetuses in the densities of PCNA-IR cells in the subventricular zone and subgranular zone at 50 and 60dg. These findings suggest that the survival of neurons in the cerebral cortex is decreased by chronic prenatal hypoxia at 60dg.

Copyright © 2015 Elsevier GmbH. All rights reserved.

Science Infos Paralyse Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 14 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org 14

PMID: 25794637 [PubMed - indexed for MEDLINE]

Microglial migration and interactions with dendrimer nanoparticles are altered in the presence of neuroinflammation.

Zhang F, Nance E, Alnasser Y, Kannan R, Kannan S.

J Neuroinflammation. 2016 Mar 22;13(1):65. doi: 10.1186/s12974-016-0529-3.

BACKGROUND: Microglial cells have been implicated in neuroinflammation-mediated injury in the brain, including neurodevelopmental disorders such as cerebral palsy (CP) and autism. Pro-inflammatory activation of microglial cells results in the impairment of their neuroprotective functions, leading to an exaggerated, ongoing immune dysregulation that can persist long after the initial insult. We have previously shown that dendrimer-mediated delivery of an anti-inflammatory agent can attenuate inflammation in a rabbit model of maternal inflammation-induced CP and significantly improve the motor phenotype, due to the ability of the dendrimer to selectively localize in activated microglia.

METHODS: To elucidate the interactions between dendrimers and microglia, we created an organotypic whole-hemisphere brain slice culture model from newborn rabbits with and without exposure to inflammation in utero. We then used this model to analyze the dynamics of microglial migration and their interactions with dendrimers in the presence of neuroinflammation.

RESULTS: Microglial cells in animals with CP had an amoeboid morphology and impaired cell migration, demonstrated by decreased migration distance and velocity when compared to cells in healthy, age-matched controls. However, this decreased migration was associated with a greater, more rapid dendrimer uptake compared to microglial cells from healthy controls.

CONCLUSIONS: This study demonstrates that maternal intrauterine inflammation is associated with impaired microglial function and movement in the newborn brain. This microglial impairment may play a role in the development of ongoing brain injury and CP in the offspring. Increased uptake of dendrimers by the "impaired" microglia can be exploited to deliver drugs specifically to these cells and modulate their functions. Host tissue and target cell characteristics are important aspects to be considered in the design and evaluation of targeted dendrimer-based nanotherapeutics for improved and sustained efficacy. This ex vivo model also provides a rapid screening tool for evaluation of the effects of various therapies on microglial function.

[Free PMC Article](#)

PMCID: PMC4802843

PMID: 27004516 [PubMed - in process]

Peptidylarginine Deiminases as Drug Targets in Neonatal Hypoxic-Ischemic Encephalopathy.

Lange S.

Front Neurol. 2016 Feb 22;7:22. doi: 10.3389/fneur.2016.00022. eCollection 2016.

Oxygen deprivation and infection are major causes of perinatal brain injury leading to cerebral palsy and other neurological disabilities. The identification of novel key factors mediating white and gray matter damage are crucial to allow better understanding of the specific contribution of different cell types to the injury processes and pathways for clinical intervention. Recent studies in the Rice-Vannucci mouse model of neonatal hypoxic ischemia (HI) have highlighted novel roles for calcium-regulated peptidylarginine deiminases (PADs) and demonstrated neuroprotective effects of pharmacological PAD inhibition following HI and synergistic infection mimicked by lipopolysaccharide stimulation.

[Free PMC Article](#)

PMCID: PMC4761975

PMID: 26941709 [PubMed]

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

Hübner S, Reich B, Heckmann M.

Biochem Pharmacol. 2015 Dec 15;98(4):556-63. doi: 10.1016/j.bcp.2015.08.093. Epub 2015 Aug 20.

Preterm birth is a major risk factor for cerebral complications, such as hemorrhage or periventricular leukomalacia, which lead to lifelong neurodevelopmental deficits. Hypoxia/ischemia, inflammation, hyperoxia, and prematurity itself

Science Infos Paralysie Cérébrale , mars 2016, **FONDATION MOTRICE** 67 rue Vergniaud 75013 Paris - tel +33 15 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

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

copyright © 2015 Elsevier Inc. All rights reserved.

PMID: 26300058 [PubMed - indexed for MEDLINE]

Syngeneic transplantation of newborn splenocytes in a murine model of neonatal ischemia-reperfusion brain injury.

Wang F, Shen Y, Tsuru E, Yamashita T, Baba N, Tsuda M, Maeda N, Sagara Y.

J Matern Fetal Neonatal Med. 2015 May;28(7):842-7. doi: 10.3109/14767058.2014.935327. Epub 2014 Jul 17.

OBJECTIVE: Neonatal hypoxic-ischemic encephalopathy (HIE) is caused by brain injury that occurs in a developing fetus or infant. Stem cell transplantation can reportedly induce functional recovery in animal models of HIE. Murine neonatal splenocytes are enriched with immature blood stem cells and are used for the investigation of murine models of syngeneic transplantation. The aim of this study was to investigate the therapeutic potential of newborn splenocytes in a murine model of neonatal ischemia-reperfusion brain injury.

METHODS: C57BL/6N mice (postnatal day 7) underwent right common carotid artery occlusion with an aneurysm clip. Following hypoxic exposure, reperfusion was achieved by unclamping the artery. Newborn splenocytes were transplanted intravenously at 3 weeks after injury.

RESULTS: The splenocytes transplanted group tended to show an improvement in behavioral tests, but it was not significantly different compared with the control groups. The transplanted cells were localized in various organs including injured brain tissue over 3 weeks. In the penumbra region of the brain, vascular endothelial growth factor (VEGF) expression was upregulated after transplantation.

CONCLUSIONS: These results showed that syngeneic transplantation of newborn splenocytes achieved the long-term survival of the grafts and exerted influence the microenvironment in the injured brains of mice.

PMID: 24939627 [PubMed - indexed for MEDLINE]

Time dependent impact of perinatal hypoxia on growth hormone, insulin-like growth factor 1 and insulin-like growth factor binding protein-3.

Kartal Ö, Aydınöz S, Kartal AT, Kelestemur T, Caglayan AB, Beker MC, Karademir F, Süleymanoğlu S, Kul M, Yulug B, Kilic E

Metab Brain Dis. 2016 Mar 4. [Epub ahead of print]

Hypoxic-ischemia (HI) is a widely used animal model to mimic the preterm or perinatal sublethal hypoxia, including hypoxic-ischemic encephalopathy. It causes diffuse neurodegeneration in the brain and results in mental retardation, hyperactivity, cerebral palsy, epilepsy and neuroendocrine disturbances. Herein, we examined acute and subacute correlations between neuronal degeneration and serum growth factor changes, including growth hormone (GH), insulin-like growth factor 1 (IGF-1) and insulin-like growth factor binding protein-3 (IGFBP-3) after hypoxic-ischemia (HI) in neonatal rats. In the acute phase of hypoxia, brain volume was increased significantly as compared with control animals, which was associated with reduced GH and IGF-1 secretions. Reduced neuronal survival and increased DNA fragmentation were also noticed in these animals. However, in the subacute phase of hypoxia, neuronal survival and brain volume were significantly decreased, accompanied by increased apoptotic cell death in the hippocampus and cortex. Serum GH, IGF-1, and IGFBP-3 levels were significantly reduced in the subacute phase of HI. Significant retardation in the brain and body development were noted in the subacute phase of hypoxia. Here, we provide evidence that serum levels of growth-hormone and factors were decreased in the acute and subacute phase of hypoxia, which was associated with increased DNA fragmentation and decreased neuronal survival.

Science Infos Paralysie Cérébrale , mars 2016, **FONDATION MOTRICE** 67 rue Vergniaud 75013 Paris - tel +33 16 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

PMID: 26943480 [PubMed - as supplied by publisher]

Whole-Brain DTI Assessment of White Matter Damage in Children with Bilateral Cerebral Palsy: Evidence of Involvement beyond the Primary Target of the Anoxic Insult.

Arrigoni F, Peruzzo D, Gagliardi C, Maghini C, Colombo P, Iammarrone FS, Pierpaoli C, Triulzi F, Turconi AC.
AJNR Am J Neuroradiol. 2016 Mar 17. [Epub ahead of print]

BACKGROUND AND PURPOSE: Cerebral palsy is frequently associated with both motor and nonmotor symptoms. DTI can characterize the damage at the level of motor tracts but provides less consistent results in nonmotor areas. We used a standardized pipeline of analysis to describe and quantify the pattern of DTI white matter abnormalities of the whole brain in a group of children with chronic bilateral cerebral palsy and periventricular leukomalacia. We also explored potential correlations between DTI and clinical scale metrics.

MATERIALS AND METHODS: Twenty-five patients (mean age, 11.8 years) and 25 healthy children (mean age, 11.8 years) were studied at 3T with a 2-mm isotropic DTI sequence. Differences between patients and controls were assessed both voxelwise and in ROIs obtained from an existing DTI atlas. Clinical metrics included the Gross Motor Function Classification System, the Manual Ability Classification System, and intelligence quotient.

RESULTS: The voxel-level and ROI-level analyses demonstrated highly significant ($P < .001$) modifications of DTI measurements in patients at several levels: cerebellar peduncles, corticospinal tracts and posterior thalamic radiations, posterior corpus callosum, external capsule, anterior thalamic radiation, superior longitudinal fasciculi and corona radiata, optic nerves, and chiasm. The reduction of fractional anisotropy values in significant tracts was between 8% and 30%. Statistically significant correlations were found between motor impairment and fractional anisotropy in corticospinal tracts and commissural and associative tracts of the supratentorial brain.

CONCLUSIONS: We demonstrated the involvement of several motor and nonmotor areas in the chronic damage associated with periventricular leukomalacia and showed new correlations between motor skills and DTI metrics.

© 2016 American Society of Neuroradiology.

PMID: 26988814 [PubMed - as supplied by publisher]

Données cliniques

Barriers and enablers to implementing antenatal magnesium sulphate for fetal neuroprotection guidelines: a study using the theoretical domains framework.

Bain E, Bubner T, Ashwood P, Van Ryswyk E, Simmonds L, Reid S, Middleton P, Crowther CA.
BMC Pregnancy Childbirth. 2015 Aug 18;15:176. doi: 10.1186/s12884-015-0618-9.

BACKGROUND: Strong evidence supports administration of magnesium sulphate prior to birth at less than 30 weeks' gestation to prevent very preterm babies dying or developing cerebral palsy. This study was undertaken as part of The WISH (Working to Improve Survival and Health for babies born very preterm) Project, to assess health professionals' self-reported use of antenatal magnesium sulphate, and barriers and enablers to implementation of 2010 Australian and New Zealand clinical practice guidelines.

METHODS: Semi-structured, one-to-one interviews were conducted with obstetric and neonatal consultants and trainees, and midwives in 2011 ($n = 24$) and 2012-2013 ($n = 21$) at the Women's and Children's Hospital, South Australia. Transcribed interview data were coded using the Theoretical Domains Framework (describing 14 domains related to behaviour change) for analysis of barriers and enablers.

RESULTS: In 2012-13, health professionals more often reported 'routinely' or 'sometimes' administering or advising their colleagues to administer magnesium sulphate for fetal neuroprotection (86% in 2012-13 vs. 46% in 2011). 'Knowledge and skills', 'memory, attention and decision processes', 'environmental context and resources', 'beliefs about consequences' and 'social influences' were key domains identified in the barrier and enabler analysis. Perceived barriers were the complex administration processes, time pressures, and the unpredictability of preterm birth. Enablers included education for staff and women at risk of very preterm birth, reminders and 'prompts', simplified processes for administration, and influential colleagues.

CONCLUSIONS: This study has provided valuable data on barriers and enablers to implementing magnesium sulphate for fetal neuroprotection, with implications for designing and modifying future behaviour change strategies, to ensure optimal uptake of this neuroprotective therapy for very preterm infants.

[Free PMC Article](#)

Science Infos Paralysie Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 17 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

PMCID: PMC4539663

PMID: 26283623 [PubMed - indexed for MEDLINE]

Comparison of psychomotor outcome in patients with perinatal asphyxia with versus without therapeutic hypothermia at 4 years using the Ages and Stages Questionnaire screening tool.

Zonnenberg IA, Koopman C, van Schie PE, Vermeulen RJ, Groenendaal F, van Weissenbruch MM.

Eur J Paediatr Neurol. 2016 Mar 2. pii: S1090-3798(16)00044-1. doi: 10.1016/j.ejpn.2016.02.011. [Epub ahead of print]

INTRODUCTION: Therapeutic hypothermia improves outcome after perinatal asphyxia. The Ages and Stages Questionnaire is a screening tool to detect neurodevelopmental delay. In this study we examined the outcome of patients with perinatal asphyxia (defined as Apgar score <5 at 10 min, or continued need for resuscitation, or pH < 7.00 in umbilical cord or within one hour after birth) with and without therapeutic hypothermia treatment at the age of four years.

METHODS: Cohort study of patients with perinatal asphyxia admitted to the Neonatal Intensive Care Units of the VU University Medical Center, Amsterdam and the Wilhelmina Children's Hospital, Utrecht in the year 2008. Parents were asked to fill out the 48 months Ages and Stages Questionnaire (ASQ). In Wilhelmina Children's Hospital treatment with therapeutic hypothermia was implemented in 2008, in the VU University Medical Center in 2009, providing a historical cohort.

RESULTS/DISCUSSION: Twenty-three questionnaires were evaluated. Response rate of questionnaires for the VU Medical Center was 63% (n = 10) and Wilhelmina's Children's Hospital 93% (n = 13). No significant differences were found in the mean scores between both groups. However, the untreated group scored more frequently under the -2 SD threshold. In the fine motor skills domain the difference was statistically significant (p = 0.031). In the treated group no patients developed cerebral palsy and in the untreated group two patients developed cerebral palsy.

CONCLUSION: In this study patients treated with hypothermia tend to have a better neurodevelopmental outcome. No significant differences were found between the two groups, apart from the fine motor skills.

Copyright © 2016 European Paediatric Neurology Society. Published by Elsevier

Ltd. All rights reserved.

PMID: 26970946 [PubMed - as supplied by publisher]

MRI and Motor Outcomes in Children with Cerebral Palsy.

Pediatr Neurol Briefs. 2015 Aug;29(8):60. doi: 10.15844/pedneurbriefs-29-8-3.

Gaebler-Spira D, McCormick K.

Investigators from University of Melbourne, Monash Children's Hospital, Royal Children's Hospital & Murdoch Children's Research Institute sought to identify correlation between magnetic resonance imaging (MRI) characteristics including white matter injury (WMI) in children with cerebral palsy (CP) and severity in motor outcomes later in life, irrespective of CP subtype.

[Free PMC Article](#)

PMCID: PMC4747131

PMID: 26933597 [PubMed]

Nonreceipt of antenatal magnesium sulphate for fetal neuroprotection at the Women's and Children's Hospital, Adelaide 2010-2013.

Aust N Z J Obstet Gynaecol. 2015 Jun;55(3):233-8. doi: 10.1111/ajo.12334.

Siwicki K, Bain E, Bubner T, Ashwood P, Middleton P, Crowther CA.

BACKGROUND: Australian and New Zealand clinical practice guidelines, endorsed by the NHMRC in 2010, recommend administration of antenatal magnesium sulphate to women at risk of imminent preterm birth at less than 30 weeks' gestation to reduce the risk of their very preterm babies dying or having cerebral palsy. The purpose of the ongoing Working to Improve Survival and Health for babies born very preterm (WISH) implementation project is to monitor and improve the uptake of this neuroprotective therapy across Australia and New Zealand.

AIMS: To quantify and explore reasons for nonreceipt of antenatal magnesium sulphate at the Women's and Children's Hospital, in Adelaide, South Australia.

MATERIALS AND METHODS: Data from the case records of women who gave birth between 23(+0) and 29(+6) weeks' gestation from 2010 to mid-2013 were reviewed to determine the proportion of eligible mothers not receiving antenatal magnesium sulphate and to explore reason(s) for nonreceipt over this time period.

RESULTS: There was a reduction in the proportion of eligible mothers not receiving antenatal magnesium sulphate from 2010 (69.7%) to 2011 (26.9%), which was maintained in 2012 and 2013 (22.5%). In 2012-2013, nonreceipt was predominantly associated with immediately imminent (advanced labour, rapid progression of labour) or indicated emergent birth (actual or suspected maternal or fetal compromise).

CONCLUSIONS: Use of antenatal magnesium sulphate at the Women's and Children's Hospital is now predominantly in-line with the binational guideline recommendations. Ongoing education and enhanced familiarity with procedures may facilitate timely administration in the context of some precipitous or immediately imminent births.

© 2015 The Royal Australian and New Zealand College of Obstetricians and Gynaecologists.

PMID: 26084194 [PubMed - indexed for MEDLINE]

Détection – Diagnostic

+Données cliniques

Fidgety movements - tiny in appearance, but huge in impact.

Einspieler C(1), Peharz R(2), Marschik PB(2).

J Pediatr (Rio J). 2016 Mar 17. pii: S0021-7557(16)00051-6. doi: 10.1016/j.jpeds.2015.12.003. [Epub ahead of print]

OBJECTIVES: To describe fidgety movements (FMs), i.e., the spontaneous movement pattern that typically occurs at 3-5 months after term age, and discuss its clinical relevance.

SOURCES: A comprehensive literature search was performed using the following databases: MEDLINE/PubMed, CINAHL, The Cochrane Library, Science Direct, PsycINFO, and EMBASE. The search strategy included the MeSH terms and search strings ('fidgety movement*') OR [('general movement*') AND ('three month*') OR ('3 month*')], as well as studies published on the General Movements Trust website (www.general-movements-trust.info).

SUMMARY OF THE DATA: Virtually all infants develop normally if FMs are present and normal, even if their brain ultrasound findings and/or clinical histories indicate a disposition to later neurological deficits. Conversely, almost all infants who never develop FMs have a high risk for neurological deficits such as cerebral palsy, and for genetic disorders with a late onset. If FMs are normal but concurrent postural patterns are not age-adequate or the overall movement character is monotonous, cognitive and/or language skills at school age will be suboptimal. Abnormal FMs are unspecific and have a low predictive power, but occur exceedingly in infants later diagnosed with autism.

CONCLUSIONS: Abnormal, absent, or sporadic FMs indicate an increased risk for later neurological dysfunction, whereas normal FMs are highly predictive of normal development, especially if they co-occur with other smooth and fluent movements. Early recognition of neurological signs facilitates early intervention. It is important to re-assure parents of infants with clinical risk factors that the neurological outcome will be adequate if FMs develop normally.

Copyright © 2016 Sociedade Brasileira de Pediatria. Published by Elsevier Editora Ltda. All rights reserved.

[Free Article](#)

PMID: 26997356 [PubMed - as supplied by publisher]

Predictors for early diagnosis of cerebral palsy from national registry data.

Granild-Jensen JB, Rackauskaite G, Flachs EM, Uldall P.

Dev Med Child Neurol. 2015 Oct;57(10):931-5. doi: 10.1111/dmcn.12760. Epub 2015 Apr 9.

Comment in Dev Med Child Neurol. 2015 Oct;57(10):891.

AIM: As early intervention is important in cerebral palsy (CP), an early diagnosis is desirable. The aim of this study was to establish the median diagnostic age of CP and to identify predictors of an early diagnosis in a population-based cohort.

METHOD: Using the Danish National Cerebral Palsy Registry (NCPR), we identified 1291 children with CP (764 males, 527 females) born between 1995 and 2003. The date of diagnosis was defined as the day the parents were told that their child was spastic or had CP. We calculated the age of diagnosis and analysed the following predictors: type of CP,

Science Infos Paralysie Cérébrale , mars 2016, **FONDATION MOTRICE** 67 rue Vergniaud 75013 Paris - tel +33 19 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

degree of motor disability, cerebral ultrasonography results, epilepsy, gestational age, and degree of cognitive impairment.

RESULTS: We found the overall median corrected diagnostic age of CP to be 11 months. Early diagnosis was associated with the type of CP, presence of epilepsy, a high degree of motor disability, and abnormalities in the cerebral ultrasonography. The gestational age was not associated with the diagnostic age.

INTERPRETATION: The median diagnostic age implies that half of the Danish children with CP will be able to enter an early intervention program before 1 year of age. A late diagnosis was associated with less severe symptoms, and gestational age did not influence the diagnostic age.

© 2015 Mac Keith Press.

PMID: 25855100 [PubMed - indexed for MEDLINE]

Serial 1- and 2-Dimensional Cerebral MRI Measurements in Full-Term Infants after Perinatal Asphyxia.

Spring In 't Veld LG(1), de Vries LS, Alderliesten T, Benders MJ, Groenendaal F.

Neonatology. 2016 Mar 12;110(1):27-32. [Epub ahead of print]

OBJECTIVE: Cranial magnetic resonance imaging (MRI) is associated with neurodevelopmental outcome in full-term infants with neonatal encephalopathy (NE) following presumed perinatal asphyxia. The aim of this study is to relate 2-dimensional measurements of the basal ganglia and thalami (BGT) and cerebellum in the first week after birth and after 3 months with neurodevelopmental outcome at 18 months.

METHODS: Retrospectively, 29 full-term infants with NE following presumed perinatal asphyxia who had a cranial MRI in the first week after birth were studied serially. One- and 2-dimensional measurements were obtained and related to different patterns of brain injury, and neurodevelopmental outcome at 18 months. A Griffiths developmental quotient <85 or cerebral palsy was considered adverse.

RESULTS: On the first MRI, the adverse outcome group showed increased basal ganglia width (42.1 ± 0.1 vs. 40.3 ± 0.3 mm, $p < 0.001$), thalamic width (40.3 ± 0.1 vs. 39.3 ± 1.0 mm, $p < 0.001$), and basal ganglia surface ($1,230 \pm 21$ vs. $1,199 \pm 36$ mm², $p = 0.007$) compared to the favorable outcome group. In the BGT lesions group, basal ganglia width and thalamic width were increased compared to the watershed infarction group (42.1 ± 0.1 vs. 40.9 ± 0.8 mm, $p < 0.001$, and 40.3 ± 0.1 vs. 39.9 ± 0.5 mm, $p = 0.01$, respectively). On the second MRI, cerebellar width was larger in the favorable outcome group ($p = 0.025$). There was a greater increase in dimensions between both MRI time points for basal ganglia width ($p = 0.014$), basal ganglia surface ($p = 0.028$) and thalamic width ($p = 0.012$) in the favorable outcome group.

CONCLUSIONS: One- and 2-dimensional measurements for basal ganglia surface, BGT width and cerebellar width are associated with neurodevelopmental outcome at 18 months.

© 2016 S. Karger AG, Basel.

PMID: 26968012 [PubMed - as supplied by publisher]

Motricité - Mobilité – Posture

A Descriptive Study of Lower Limb Torsional Kinematic Profiles in Children With Spastic Diplegia.

Simon AL, Ilharreborde B, Megrot F, Mallet C, Azarpira R, Mazda K, Presedo A, Penneçot GF.

J Pediatr Orthop. 2015 Sep;35(6):576-82. doi: 10.1097/BPO.0000000000000331.

BACKGROUND: Lower limb rotational anomalies in spastic diplegic children with cerebral palsy (CP) are common and difficult to identify through physical examination alone. The identification and treatment of the overall rotational disorders must be considered to restore physiological lever-arms lengths and lever-arms orientation. The aims of the study were to assess the prevalence of lower limb rotational malalignment and to describe the distribution of the different kinematic torsional profiles in children with spastic diplegia.

METHODS: Instrumented gait analysis data from 188 children with spastic diplegia were retrospectively reviewed. None of the patients had undergone surgery previously or received botulinum toxin treatment within 6 months before the review. Kinematic data, collected at the midstance phase, included: pelvic, hip, and ankle rotation and foot progression angle.

RESULTS: The prevalence of kinematic rotational deviations was 98.4%. Sixty-one percent of the children walked with an internal foot progression angle and 21% exhibited external alignment. The pelvis was internally rotated in 1% of

the cases and externally in another 27%. Hip rotation was internal in 29% and external in 27% of the cases. Ankle rotation was internal in 55% and external in 16% of the cases. Lower limb rotational anomalies involved more than one level in 77% of the limbs. A kinematic compensatory deviation was identified in at least one level in 48% of the limbs.

CONCLUSIONS: Kinematic rotational anomalies were identified in nearly all the 188 children in the study. The multilevel involvement of lower limb malalignment was not systematically associated with compensatory mechanisms between the levels. Ankle rotational anomalies were the most frequent cause of lower limb torsional deviations followed by pelvic malalignment.

LEVEL OF EVIDENCE: Level IV.

PMID: 25333905 [PubMed - indexed for MEDLINE]

A descriptive analysis of the upper limb patterns during gait in individuals with cerebral palsy.

Bonnefoy-Mazure A, Sagawa Y Jr, Lascombes P, De Coulon G, Armand S.

Res Dev Disabil. 2014 Nov;35(11):2756-65. doi: 10.1016/j.ridd.2014.07.013. Epub 2014 Jul 31.

Patients with cerebral palsy (CP) are characterized by a large diversity of gait deviations; thus, lower limb movements during gait have been well-analyzed in the literature. However, the question of upper limb movements and, more particularly, arm movements during gait has received less attention for CP patients as a function of the disease type (Hemiplegic, HE or Diplegic, DI). Thus, the aim of this study was to investigate upper limb movements for a large group of CP patients; we used a retrospective search, including upper limb kinematic parameters and 92 CP patients (42 females and 50 males, mean±standard deviation (SD); age: 15.2±6.7 years). The diagnoses consisted of 48 HE and 44 DI. A control group of 15 subjects (7 females and 8 males, age: 18.4±8.4 years) was included in the study to provide normal gait data. For the DI patients and CG, 88 arms and 30 arms were analyzed, respectively. For the HE patients, 48 affected arms and 48 non-affected arms were analyzed. The kinematic parameters selected and analyzed were shoulder elevation angles; elbow flexion angles; thorax tilt and obliquity angles; hand vertical and anterior-posterior movements; and arm angles. Several gait parameters were also analyzed, such as the gait profile score (GPS) and normalized speed. Statistical analyses were performed to compare CG with the affected and non-affected upper limbs of HE patients and with the two upper limbs of DI patients. The results show that HE and DI patients adopt abnormal upper limb movements. However, DI patients have greater shoulder, elbow, thorax and arm angle movements compared with HE patients. However, HE patients adopt different movements between their affected and non-affected arms. Thus, the patients used their upper limbs to optimize their gait more where gait deviations were more important. These observations confirm that the upper limbs must be integrated into rehabilitation programs to improve inter-limb coordination.

Copyright © 2014 Elsevier Ltd. All rights reserved.

PMID: 25084472 [PubMed - indexed for MEDLINE]

Assessment of net knee moment-angle characteristics by instrumented hand-held dynamometry in children with spastic cerebral palsy and typically developing children.

Haberfehlner H, Maas H, Harlaar J, Newsum IE, Becher JG, Buizer AI, Jaspers RT.

J Neuroeng Rehabil. 2015 Aug 15;12:67. doi: 10.1186/s12984-015-0056-y.

BACKGROUND: The limited range of motion during walking in children with spastic cerebral palsy (SCP) may be the result of altered mechanical characteristics of muscles and connective tissues around the knee joint. Measurement of static net knee moment-angle relation will provide insights into these alterations, for which instrumented hand-held dynamometry may be applied. The aims of this study were: (1) to test the measurement error of the estimated net knee moment-angle characteristics, (2) to determine the correlation between knee extension angle measurement at a standardized knee moment and popliteal angle from common physical examination and (3) to compare net knee moment-angle characteristics in SCP versus typically developing children.

METHODS: With the child lying in sideward position, the knee was extended by moving the lower leg by a hand-held force transducer on a low friction cart. Force data were collected for a range of knee angles. Data were excluded when activity (EMG) levels of knee extensor and flexor muscles exceeded the EMG level during rest by more than two standard deviations. The net knee flexion moments were calculated from recorded force data and measured moment arm. Reliability for knee angles corresponding with 0.5, 1, 2, 3, and 4 Nm knee net flexion moments was assessed by standard error of measurements (SEM) and smallest detectable difference (SDD).

RESULTS: For between day comparison, SEMs were about 5° and SDDs were below 14° for knee angles at 1-4 Nm net knee flexion moments. In SCP children, the knee angle measured at 4 Nm knee flexion moment was not related to the popliteal angle ($r = 0.52$). The slope at 4 Nm of the knee moment-angle curve in SCP children was significantly higher than that in typically developing children.

CONCLUSIONS: The presented knee hand-held dynamometry allows assessment of net knee flexion moment-knee angle characteristics in typically developing and SCP children and can be used to identify clinically relevant changes as a result of treatment. Overall stiffness of structures that contribute to the net knee flexion moment at the knee (i.e. muscles, tendons, ligaments) is elevated in SCP children.

[Free PMC Article](#)

PMCID: PMC4536590

PMID: 26272620 [PubMed - indexed for MEDLINE]

Classification of gait disorders following traumatic brain injury.

Williams G, Lai D, Schache A, Morris ME.

J Head Trauma Rehabil. 2015 Mar-Apr;30(2):E13-23. doi: 10.1097/HTR.000000000000038.

OBJECTIVE: To determine the extent to which gait disorders associated with traumatic brain injury (TBI) are able to be classified into clinically relevant and distinct subgroups.

DESIGN: Cross-sectional cohort study comprising people with TBI receiving physiotherapy for mobility limitations.

PARTICIPANTS: One hundred two people with TBI.

OUTCOME MEASURES: The taxonomic framework for gait disorders following TBI was devised on the basis of a framework previously developed for people with cerebral palsy. Participants with TBI who were receiving therapy for mobility problems were assessed using 3-dimensional gait analysis. Pelvis and bilateral lower limb kinematic data were recorded using a VICON motion analysis system while each participant walked at a self-selected speed. Five trials of data were collected for each participant. Multiclass support vector machine models were developed to systematically and automatically ascertain the clinical classification.

RESULTS: The statistical features derived from the major joint angles from unaffected limbs contributed to the best classification accuracy of 82.35% (84 of the 102 subjects). Features from the affected limb resulted in a classification accuracy of 76.47% (78 of 102 subjects).

CONCLUSIONS: Despite considerable variability in gait disorders following TBI, we were able to generate a clinical classification system on the basis of 6 distinct subgroups of gait deviations. Statistical features related to the motion of the pelvis, hip, knee, and ankle on the less affected leg were able to accurately classify 82% of people with TBI-related gait disorders using a multiclass support vector machine framework.

PMID: 24695264 [PubMed - indexed for MEDLINE]

Clinical tools designed to assess motor abilities in children with cerebral palsy.

Pavão SL, Silva FP, Dusing SC, Rocha NA.

Dev Neurorehabil. 2016 Mar 28:1-11. [Epub ahead of print]

OBJECTIVE: This systematic review aimed to list the tools used by rehabilitation professionals to test motor abilities in children with cerebral palsy (CP), to determine if these tools have psychometric properties specifically measured for CP, and to identify the main characteristics of these tools.

METHOD: Web of Science, PEDro, PubMed/MEDLINE, Science Direct, and SciELO databases were searched to identify the tools. PubMed/MEDLINE was then searched to identify the studies assessing those tools' psychometric properties. The agreement-based standards for the selection of health measurement tools and the Terwee criteria were used to assess the quality and the results of each included study, respectively.

RESULTS: Eighteen tools were identified. The psychometric properties of many of the tools used with children with CP have not been evaluated for this population.

CONCLUSION: The psychometric properties evaluated often have a poor methodological quality of measurement. Overall, we suggest the tools with most empirical support to evaluate children with CP.

PMID: 27019351 [PubMed - as supplied by publisher]

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]

Science Infos Paralyse Cérébrale , mars 2016, [FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 22 1 45 54 03 03 contact: Christine Doumergue \[cdoumergue@lafondationmotrice.org\]\(mailto:cdoumergue@lafondationmotrice.org\)](#)

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.

© 2016 American Physical Therapy Association.

PMID: 26916928 [PubMed - as supplied by publisher]

Developing the Observatory Test of Capacity, Performance, and Developmental Disregard (OTCPDD) for Children with Cerebral Palsy.

Liu KC, Chen HL, Wang TN, Shieh JY.

PLoS One. 2016 Mar 24;11(3):e0151798. doi: 10.1371/journal.pone.0151798.eCollection 2016.

PURPOSE: The purpose of this study was to develop a reliable and valid instrument, named the Observatory Test of Capacity, Performance, and Developmental Disregard (OTCPDD), for measuring the amount and quality of use of affected upper limb functions in the daily routines of children with CP.

METHODS: Forty-eight participants (24 children with CP and 24 matched typically developing children) were recruited. The OTCPDD was administered twice (the spontaneous use condition first, followed by the forced use condition) on children with CP. Their parents were asked to complete the Pediatric Motor Activity Log-Revised (PMAL-R). The internal consistency, the intrarater and interrater reliabilities, and the convergent and discriminate validities were measured.

RESULTS: The internal consistency (Cronbach's alpha) and the intrarater and interrater reliabilities were higher than 0.9 for all of the OTCPDD scores. The convergent validity was confirmed by significant correlations between the OTCPDD and the PMAL-R. For the discriminant validity, significant differences ($p < 0.05$) were found between children with CP and typically developing children.

CONCLUSIONS: The results support that the OTCPDD is a reliable and valid observation-based assessment. The OTCPDD, which uses bimanual daily living activities, is able to represent the children's general affected hand functions (including capacity, performance, and developmental disregard) in their daily routines.

[Free Article](#)

PMID: 27010941 [PubMed - in process]

Functional classifications for cerebral palsy: correlations between the gross motor function classification system (GMFCS), the manual ability classification system (MACS) and the communication function classification system (CFCS).

Compagnone E, Maniglio J, Camposeo S, Vespino T, Losito L, De Rinaldis M, Gennaro L, Trabacca A.

Res Dev Disabil. 2014 Nov;35(11):2651-7. doi: 10.1016/j.ridd.2014.07.005. Epub 2014 Jul 23.

This study aimed to investigate a possible correlation between the gross motor function classification system-expanded and revised (GMFCS-E&R), the manual abilities classification system (MACS) and the communication

Science Infos Paralysie Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 23 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

function classification system (CFCS) functional levels in children with cerebral palsy (CP) by CP subtype. It was also geared to verify whether there is a correlation between these classification systems and intellectual functioning (IF) and parental socio-economic status (SES). A total of 87 children (47 males and 40 females, age range 4-18 years, mean age 8.9 ± 4.2) were included in the study. A strong correlation was found between the three classifications: Level V of the GMFCS-E&R corresponds to Level V of the MACS ($r_s=0.67$, $p=0.001$); the same relationship was found for the CFCS and the MACS ($r_s=0.73$, $p<0.001$) and for the GMFCS-E&R and the CFCS ($r_s=0.61$, $p=0.001$). The correlations between the IQ and the global functional disability profile were strong or moderate (GMFCS and IQ: $r_s=0.66$, $p=0.001$; MACS and IQ: $r_s=0.58$, $p=0.001$; CFCS and MACS: $r_s=0.65$, $p=0.001$). The Kruskal-Wallis test was used to determine if there were differences between the GMFCS-E&R, the CFCS and the MACS by CP type. CP types showed different scores for the IQ level (Chi-square=8.59, $df=2$, $p=0.014$), the GMFCS-E&R (Chi-square=36.46, $df=2$, $p<0.001$), the CFCS (Chi-square=12.87, $df=2$, $p=0.002$), and the MACS Level (Chi-square=13.96, $df=2$, $p<0.001$) but no significant differences emerged for the SES (Chi-square=1.19, $df=2$, $p=0.554$). This study shows how the three functional classifications (GMFCS-E&R, CFCS and MACS) complement each other to provide a better description of the functional profile of CP. The systematic evaluation of the IQ can provide useful information about a possible future outcome for every functional level. The SES does not appear to affect functional profiles.

Copyright © 2014 Elsevier Ltd. All rights reserved.

PMID: 25062096 [PubMed - indexed for MEDLINE]

Gait pattern recognition in cerebral palsy patients using neural network modelling.

Muhammad J, Gibbs S, Abboud R, Anand S, Wang W.

J Ayub Med Coll Abbottabad. 2015 Oct-Dec;27(4):754-8.

BACKGROUND: Interpretation of gait data obtained from modern 3D gait analysis is a challenging and time consuming task. The aim of this study was to create neural network models which can recognise the gait patterns from pre- and post-treatment and the normal ones. Neural network is a method which works on the principle of learning from experience and then uses the obtained knowledge to predict the unknowns.

METHODS: Twenty-eight patients with cerebral palsy were recruited as subjects whose gait was analysed in pre and post-treatment. A group of twenty-six normal subjects also participated in this study as control group. All subjects' gait was analysed using Vicon Nexus to obtain the gait parameters and kinetic and kinematic parameters of hip, knee and ankle joints in three planes of both limbs. The gait data was used as input to create neural network models. A total of approximately 300 trials were split into 70% and 30% to train and test the models, respectively. Different models were built using different parameters. The gait modes were categorised as three patterns, i.e., normal, pre- and post-treatments.

RESULTS: The results showed that the models using all parameters or using the joint angles and moments could predict the gait patterns with approximately 95% accuracy. Some of the models e.g., the models using joint power and moments, had lower rate in recognition of gait patterns with approximately 70-90% successful ratio.

CONCLUSION: Neural network models can be used in clinical practice to recognise the gait pattern for cerebral palsy patients.

PMID: 27004315 [PubMed - in process]

Impaired gait function in adults with cerebral palsy is associated with reduced rapid force generation and increased passive stiffness.

Geertsen SS, Kirk H, Lorentzen J, Jorsal M, Johansson CB, Nielsen JB.

Clin Neurophysiol. 2015 Dec;126(12):2320-9. doi: 10.1016/j.clinph.2015.02.005. Epub 2015 Feb 21.

OBJECTIVE: It is still not clarified whether spasticity contributes to impairments of gait function. Here we compared biomechanical measures of muscle weakness and stiffness of ankle muscles to impairments of gait function in adults with cerebral palsy (CP).

METHODS: Twenty-four adults with CP (mean age 34.3, range 18-57 years) and fifteen healthy age-matched controls were biomechanically measured for passive and reflex-mediated stiffness of the ankle plantarflexors at rest, maximal voluntary plantarflexion and dorsiflexion effort (MVC_{pf},_{df}) and rate of force development (RFD_{pf},_{df}). Kinematic analysis of the ankle joint during treadmill walking was obtained by 3-D motion analysis.

RESULTS: Passive stiffness was significantly increased in adults with CP compared to controls. Passive stiffness and RFD_{df} were correlated to reduced toe lift. RFD_{pf} provided the best correlation to push-off velocity, range of movement in the ankle joint and gait speed. Reflex-mediated stiffness was not correlated to any parameters of impaired gait.

Science Infos Paralyse Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 24 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

CONCLUSIONS: Impaired gait function in adults with CP is associated with reduced RFD and increased passive stiffness of ankle muscles.

SIGNIFICANCE: These findings suggest that reduced rapid force generation and increased passive stiffness of ankle muscles rather than increased reflex-mediated stiffness (spasticity) likely contributes to impaired gait function in adults with CP.

Copyright © 2015 International Federation of Clinical Neurophysiology. Published by Elsevier Ireland Ltd. All rights reserved.

PMID: 25757398 [PubMed - indexed for MEDLINE]

Longitudinal development of hand function in children with unilateral spastic cerebral palsy aged 18 months to 12 years.

Dev Med Child Neurol. 2016 Mar 27. doi: 10.1111/dmcn.13106. [Epub ahead of print]

Nordstrand L, Eliasson AC(1), Holmefur M.

AIM: The aim of the study was to describe the development of hand function, particularly the use of the affected hand in bimanual tasks, among children with unilateral cerebral palsy aged 18 months to 12 years.

METHOD: A convenience sample of 96 children (53 males, 43 females) was assessed with the Assisting Hand Assessment (AHA) at regular intervals from the ages of 18 months to 12 years. The children ranged from 17 to 127 months (median age 24mo) at recruitment. Subgroups were created to identify differences in development using the child's AHA at 18 months and the Manual Ability Classification System (MACS). A nonlinear mixed effects model was used to analyze data according to a 'stable limit' development model.

RESULTS: The results were based on 702 AHA sessions. The children showed a rapid development at a young age and reached 90% of their stable limit between 30 months and 8 years. The subgroups, based on the 18-month AHA and the MACS levels respectively, had distinctly different patterns of development.

INTERPRETATION: The AHA at 18 months may be used to make a crude prediction of future development.

© 2016 Mac Keith Press.

PMID: 27017925 [PubMed - as supplied by publisher]

Motion analysis of the upper extremity in children with unilateral cerebral palsy--an assessment of six daily tasks.

Klotz MC, van Drongelen S, Rettig O, Wenger P, Gantz S, Dreher T, Wolf SI.

Res Dev Disabil. 2014 Nov;35(11):2950-7. doi: 10.1016/j.ridd.2014.07.021. Epub 2014 Aug 9.

Restrictions in range of motion of the upper extremity are common in patients with unilateral cerebral palsy (CP). The purpose of this study was to investigate movement deviations of the upper extremity in children with unilateral CP by means of 3D motion capture as well as by the use of easy to use scores and questionnaires (MACS, MRC, MAS, ABILHAND-Kids). 16 children with a spastic, unilateral CP were included and compared to a group of 17 typically developing adolescents (TD). The movement time and range of motion (ROM) of six uni- and bimanual daily tasks were compared and correlated with the scores and questionnaires. Movement times increased significantly with involvement according to MACS in all tasks. The restrictions in ROM were pronounced in the forearm. As a compensatory mechanism the children of the MACS 2 and 3 groups showed increased trunk movement. Furthermore, there was a positive correlation between the MACS and the ABILHAND-Kids Questionnaire. In contrast to previous studies, which reported a correlation between the restrictions in ROM and the MACS, this study showed no consistent correlation between the restrictions in ROM neither with the MACS nor with the ABILHAND-Kids. While the MACS and the ABILHAND-Kids function as a simple rating tool for clinical use, the detailed analysis of different daily tasks using 3-D-motion capture provides more detailed information about the movement deviations and spatiotemporal parameters.

Copyright © 2014 Elsevier Ltd. All rights reserved.

PMID: 25112796 [PubMed - indexed for MEDLINE]

Multilevel Upper Body Movement Control during Gait in Children with Cerebral Palsy.

Summa A, Vannozzi G, Bergamini E, Iosa M, Morelli D, Cappozzo A.

PLoS One. 2016 Mar 21;11(3):e0151792. doi: 10.1371/journal.pone.0151792. eCollection 2016.

Upper body movements during walking provide information about balance control and gait stability. Typically developing (TD) children normally present a progressive decrease of accelerations from the pelvis to the head, whereas

Science Infos Paralysie Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 25 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

children with cerebral palsy (CP) exhibit a general increase of upper body accelerations. However, the literature describing how they are transmitted from the pelvis to the head is lacking. This study proposes a multilevel motion sensor approach to characterize upper body accelerations and how they propagate from pelvis to head in children with CP, comparing with their TD peers. Two age- and gender-matched groups of 20 children performed a 10m walking test at self-selected speed while wearing three magneto-inertial sensors located at pelvis, sternum, and head levels. The root mean square value of the accelerations at each level was computed in a local anatomical frame and its variation from lower to upper levels was described using attenuation coefficients. Between-group differences were assessed performing an ANCOVA, while the mutual dependence between acceleration components and the relationship between biomechanical parameters and typical clinical scores were investigated using Regression Analysis and Spearman's Correlation, respectively ($\alpha = 0.05$). New insights were obtained on how the CP group managed the transmission of accelerations through the upper body. Despite a significant reduction of the acceleration from pelvis to sternum, children with CP do not compensate for large accelerations, which are greater than in TD children. Furthermore, those with CP showed negative sternum-to-head attenuations, in agreement with the documented rigidity of the head-trunk system observed in this population. In addition, the estimated parameters proved to correlate with the scores used in daily clinical practice. The proposed multilevel approach was fruitful in highlighting CP-TD gait differences, supported the in-field quantitative gait assessment in children with CP and might prove beneficial to designing innovative intervention protocols based on pelvis stabilization.

[Free Article](#)

PMID: 26999362 [PubMed - in process]

Quadriceps femoris spasticity in children with cerebral palsy: measurement with the pendulum test and relationship with gait abnormalities.

J Neuroeng Rehabil. 2014 Dec 16;11:166. doi: 10.1186/1743-0003-11-166.

Szopa A, Domagalska-Szopa M, Kidoń Z, Syczewska M.

BACKGROUND: Development of a reliable and objective test of spasticity is important for assessment and treatment of children with cerebral palsy. The pendulum test has been reported to yield reliable measurements of spasticity and to be sensitive to variations in spasticity in these children. However, the relationship between the pendulum test scores and other objective measures of spasticity has not been studied. The present study aimed to assess the effectiveness of an accelerometer-based pendulum test as a measurement of spasticity in CP, and to explore the correlation between the measurements of this test and the global index of deviation from normal gait in children with cerebral palsy.

METHODS: We studied thirty-six children with cerebral palsy, including 18 with spastic hemiplegia and 18 with spastic diplegia, and a group of 18 typically-developing children. Knee extensor spasticity was assessed bilaterally using the accelerometer-based pendulum test and three-dimensional gait analysis. The Gillette Gait Index was calculated from the results of the gait analysis.

RESULTS: The data from the accelerometer-based pendulum test could be used to distinguish between able-bodied children and children with cerebral palsy. Additionally, two of the measurements, first swing excursion and relaxation index, could be used to differentiate the degree of knee extensor spasticity in the children with cerebral palsy. Only a few moderate correlations were found between the Gillette Gait Index and the pendulum test data.

CONCLUSIONS: This study demonstrates that the pendulum test can be used to discriminate between typically developing children and children with CP, as well as between various degrees of spasticity, such as spastic hemiplegia and spastic diplegia, in the knee extensor muscle of children with CP. Deviations from normal gait in children with CP were not correlated with the results of the pendulum test.

[Free PMC Article](#)

PMCID: PMC4277843

PMID: 25516151 [PubMed - indexed for MEDLINE]

Reliability and validity of the Duncan-Ely test for assessing rectus femoris spasticity in patients with cerebral palsy.

Lee SY, Sung KH, Chung CY, Lee KM, Kwon SS, Kim TG, Lee SH, Lee IH, Park MS.

Dev Med Child Neurol. 2015 Oct;57(10):963-8. doi: 10.1111/dmcn.12761. Epub 2015 Apr 6.

Comment in Dev Med Child Neurol. 2015 Oct;57(10):895-6.

AIM: The aim of this study was to clarify the method of the Duncan-Ely test and to estimate its interobserver reliability and validity by comparing it with three-dimensional gait analysis (3DGA).

Science Infos Paralyse Cérébrale , mars 2016, **FONDATION MOTRICE** 67 rue Vergniaud 75013 Paris - tel +33 26 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

METHOD: This study included 36 consecutive ambulatory patients with cerebral palsy (CP) who underwent preoperative 3DGA. The Duncan-Ely test was performed during three different velocities (slow, gravity, and fast). The interobserver reliability was assessed by three examiners. The results of the test were compared with kinematic variables derived from the gait analysis to assess the sensitivity and specificity of the test. The cut-off value was determined at the point of trade-off between the highest sensitivity and specificity.

RESULTS: The intraclass correlation coefficient measuring interobserver reliability of the Duncan-Ely test was greatest during fast velocity (0.819). The sensitivity and specificity of the test during gravity velocity for knee range of motion total were 63.0% and 100% respectively, with a cut-off value of 78.3°. The sensitivity and specificity of the test during fast velocity for knee range of motion total were 66.7% and 100% respectively, with a cut-off value of 65°.

INTERPRETATION: The Duncan-Ely test shows excellent reliability in fast knee-flexion velocity, and good sensitivity and specificity compared with 3DGA during physical examination as a preoperative assessment of rectus femoris spasticity in patients with CP.

© 2015 Mac Keith Press.

PMID: 25846806 [PubMed - indexed for MEDLINE]

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, 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 β [95% confidence intervals] for CP=23.72 [6.26 to 41.18], for controls=2.72 [-10.26 to 15.69]; walking capacity β 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.

© 2016 Mac Keith Press.

PMID: 26915305 [PubMed - as supplied by publisher]

Repeatability of muscle synergies within and between days for typically developing children and children with cerebral palsy.

Shuman B, Goudriaan M, Bar-On L, Schwartz MH, Desloovere K, Steele KM.

Gait Posture. 2016 Mar;45:127-32. doi: 10.1016/j.gaitpost.2016.01.011. Epub 2016 Jan 28.

Muscle synergies are typically calculated from electromyographic (EMG) signals using nonnegative matrix factorization. Synergies identify weighted groups of muscles that are commonly activated together during a task, such as walking. Synergy analysis has become an emerging tool to evaluate neuromuscular control; however, the repeatability of synergies between trials and days has not been evaluated. The goal of this study was to evaluate the repeatability of synergy complexity and structure in unimpaired individuals and individuals with cerebral palsy (CP). EMG data were collected from eight lower-limb muscles during gait for six typically developing (TD) children and five children with CP on two separate days, over three walking speeds. To evaluate synergy complexity, we calculated the total variance accounted for by one synergy (tVAF1). On a given day, the average range in tVAF1 between gait cycles was 18.2% for TD and 19.1% for CP. The average standard deviation in tVAF1 between gait cycles was 4.9% for TD and 5.0% for CP. Average tVAF1 calculated across gait cycles was not significantly different between days for TD or CP

Science Infos Paralysie Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 27 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

participants. Comparing synergy structure, the average (standard deviation) within day correlation coefficients of synergy weights for two or more synergies were 0.89 (0.15) for TD and 0.88 (0.15) for CP. Between days, the average correlation coefficient of synergy weights for two or more synergies was greater than 0.89 for TD and 0.74 for CP. These results demonstrate that synergy complexity and structure averaged over multiple gait cycles are repeatable between days in both TD and CP groups.

Copyright © 2016 Elsevier B.V. All rights reserved.

PMID: 26979894 [PubMed - in process]

The magnitude of the somatosensory cortical activity is related to the mobility and strength impairments seen in children with cerebral palsy.

Kurz MJ, Heinrichs-Graham E, Becker KM, Wilson TW.

J Neurophysiol. 2015 May 1;113(9):3143-50. doi: 10.1152/jn.00602.2014. Epub 2015 Feb 25.

The noted disruption of thalamocortical connections and abnormalities in tactile sensory function has resulted in a new definition of cerebral palsy (CP) that recognizes the sensorimotor integration process as central to the motor impairments seen in these children. Despite this updated definition, the connection between a child's motor impairments and somatosensory processing remains almost entirely unknown. In this investigation, we explored the relationship between the magnitude of neural activity within the somatosensory cortices, the strength of the ankle plantarflexors, and the gait spatiotemporal kinematics of a group of children with CP and a typically developing matched cohort. Our results revealed that the magnitude of somatosensory cortical activity in children with CP had a strong positive relationship with the ankle strength, step length, and walking speed. These results suggest that stronger activity within the somatosensory cortices in response to foot somatosensations was related to enhanced ankle plantarflexor strength and improved mobility in the children with CP. These results provide further support for the notion that children with CP exhibit, not only musculoskeletal deficits, but also somatosensory deficits that potentially contribute to their overall functional mobility and strength limitations.

Copyright © 2015 the American Physiological Society.

PMCID: PMC4432676 [Available on 2016-05-01]

PMID: 25717160 [PubMed - indexed for MEDLINE]

The role of altered proximal femoral geometry in impaired pelvis stability and hip control during CP gait: A simulation study.

Bosmans L, Jansen K, Wesseling M, Molenaers G, Scheys L, Jonkers I.

Gait Posture. 2016 Feb;44:61-7. doi: 10.1016/j.gaitpost.2015.11.010. Epub 2015 Nov 30.

Children with cerebral palsy (CP) often present aberrant hip geometry, more specifically increased femoral anteversion and neck-shaft angle. Furthermore, altered gait patterns are present within this population. This study analyzed the effect of aberrant femoral geometry, as present in subjects with CP, on the ability of muscles to control hip and knee joint kinematics. Given the specific gait deficits observed during crouch gait, increased ability to abduct, externally rotate the hip and extend the knee and hip were denoted as beneficial effects. We ran dynamic simulations of CP and normal gait using two musculoskeletal models, one reflecting normal femoral geometry and one reflecting proximal femoral deformities. The results show that the combination of aberrant bone geometry and CP-specific gait characteristics beneficially increased the ability of gluteus medius and maximus to extend the hip and knee. In contrast, the potentials of the hamstrings to extend the hip decreased whereas the potentials to flex the knee increased. These changes closely followed the observed changes in the muscle moment arm lengths. In conclusion, this study emphasizes the concomitant effect of the presence of proximal femoral deformity and CP gait characteristics on the muscle control of hip and knee joint kinematics during single stance. Not accounting for subject-specific geometry will affect the calculated muscles' potential during gait. Therefore, the use of generic models to assess muscle function in the presence of femoral deformity and CP gait should be treated with caution.

Copyright © 2015 Elsevier B.V. All rights reserved.

PMID: 27004634 [PubMed - in process]

The Sarah evaluation scale for children and adolescents with cerebral palsy: description and results.

Pinto KS, Carvalho CG, Nakamoto L, Nunes LG.

Braz J Phys Ther. 2016 Mar 22. pii: S1413-3552016005005103. [Epub ahead of print]

Background Assessments of motor-functional aspects in cerebral palsy are crucial to rehabilitation programs. Objective To introduce the Sarah motor-functional evaluation scale and to report the initial results of its measurement properties. This scale was created based on the experience of the Sarah Network of Rehabilitation Hospitals in the care of children and adolescents with cerebral palsy. Method Preliminary results concerning the measurement properties of the scale were obtained via assessment of 76 children and adolescents with cerebral palsy. Experts' opinions were used to determine an expected empirical score by age group and to differentiate severity levels. Results The scale exhibited a high Cronbach's alpha coefficient (0.95). Strong correlation was observed with experts' classification for severity levels (0.81 to 0.97) and with the scales Gross Motor Function Measure and Pediatric Evaluation of Disability Inventory (0.80 to 0.98). Regression analysis detected a significant relationship between the scale score and the severity of the child's motor impairment. The inter-rater reliability was also strong (intraclass correlation coefficient ranging from 0.98 to 0.99). The internal responsiveness of the scale score was confirmed by significant differences between longitudinal evaluations (paired Student's t test with $p < 0.01$; standardized response mean of 0.60). Conclusion The Sarah scale provides a valid measure for assessing the motor skills and functional performance of children and adolescents with cerebral palsy. The preliminary results showed that the Sarah scale has potential for use in routine clinical practice and rehabilitation units.

[Free Article](#)

PMID: 27007025 [PubMed - as supplied by publisher]

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]

Use of sensory information during postural control in children with cerebral palsy: systematic review.

Pavão SL, Silva FP, Savelsbergh GJ, Rocha NA.

J Mot Behav. 2015;47(4):291-301. doi: 10.1080/00222895.2014.981498. Epub 2014 Dec 16.

Impairments in sensory processing in children with cerebral palsy (CP) appear to be a cause of the postural control deficits they present and may affect function and participation in daily activities. Understanding the role of sensory processing in postural control can better inform their rehabilitation. Thus, the authors aimed to systematically review the literature concerning effects of sensory information manipulation on postural control in children with CP. A tailored search strategy in relevant databases identified 11 full-text reports that fulfilled the predefined inclusion and exclusion criteria. Sensory information affects postural control in children with CP. These children are less responsive to sensory input, and therefore are less able to perform adjustments during sensory perturbation. They exhibit less postural stability in the presence of sensory conflicts. The most commonly studied sources of sensory data are visual and somatosensory information, particularly when processed under static conditions. There are no studies addressing sensory information manipulation on postural control during the performance of functional activities. Further studies addressing manipulation of new sources of sensory cues on postural control are required.

PMID: 25514677 [PubMed - indexed for MEDLINE]

Using a goal attainment scale in the evaluation of outcomes in patients with diplegic cerebral palsy.

McMorran D, Robinson LW, Henderson G, Herman J, Robb JE, Gaston MS.

Gait Posture. 2016 Feb;44:168-71. doi: 10.1016/j.gaitpost.2015.12.003. Epub 2015 Dec 14.

A goal attainment scale (GAS) was used to evaluate outcomes of surgical and non-surgical interventions to improve gait in 45 children with diplegic cerebral palsy. Personal goals were recorded during pre-intervention gait analysis in two groups. Twenty children underwent orthopaedic surgery (Group 1) and 25 children received a non-operative intervention (Group 2). Children and/or their carers were contacted post-intervention by telephone to complete a GAS questionnaire, rating the achievement of goals on a 5-point scale. The goals were similar in both groups. The composite GAS was transformed into a standardised measure (T-score) for each patient. Both groups on average achieved their goals (mean T-score for Group 2 was 56.3, versus 47.1 for Group 1). The difference between these two means was significant ($p=0.010$). Additionally, 16 children had undergone a follow-up gait analysis during the study period, but the relationship between their Gait Profile Score and GAS was not statistically significant. Both surgical and non-surgical interventions enabled children to achieve their goals, although Group 1 reported higher achievements. The GAS reflects patient's/parent's/carer's aspirations and may be as relevant as post-intervention kinematic or kinetic outcomes.

Copyright © 2015 Elsevier B.V. All rights reserved.

PMID: 27004652 [PubMed - in process]

Variation in kinematic and spatiotemporal gait parameters by Gross Motor Function Classification System level in children and adolescents with cerebral palsy.

Õunpuu S, Gorton G, Bagley A, Sison-Williamson M, Hassani S, Johnson B, Oeffinger D.

Dev Med Child Neurol. 2015 Oct;57(10):955-62. doi: 10.1111/dmcn.12766. Epub 2015 Apr 28.

AIM: The aim of this study was to examine differences in gait kinematics and spatiotemporal parameters in ambulatory children and adolescents with bilateral spastic cerebral palsy (BSCP) among Gross Motor Function Classification System (GMFCS) levels I-III.

METHOD: A retrospective review was conducted of individuals with BSCP who had three-dimensional motion analysis (3DGA) at one of seven pediatric hospitals. Means and standard deviations of each gait parameter were stratified by GMFCS levels (I-III) and for a typically developing comparison group.

RESULTS: Data from 292 children and adolescents with BSCP (189 males, 103 females; mean age 13 y) were compared to a typically developing comparison group (24 male, 26 female; mean age 10 y 6 mo). Gait patterns differed from typically developing in all GMFCS levels, with increasing deviation as GMFCS level increased in 21 out of 28 parameters. Despite significant differences in selected mean kinematic parameters among GMFCS levels such as knee angle at initial contact of 24°, 29°, and 41° in GMFCS levels I, II and III respectively, there was also substantial overlap among GMFCS levels.

INTERPRETATION: GMFCS levels cannot be identified using specific gait kinematics. Treatment decisions should be guided by comprehensive 3DGA that allows measurement of gait impairments at the joint level for each individual.

2015 Mac Keith Press.

PMID: 25926016 [PubMed - indexed for MEDLINE]

Cognition

Effects of self-control and instructor-control feedback on motor learning in individuals with cerebral palsy.

Hemayattalab R.

Res Dev Disabil. 2014 Nov;35(11):2766-72. doi: 10.1016/j.ridd.2014.07.006. Epub 2014 Jul 31.

In this study we investigated the effects of "self-control and instructor-control feedback" on motor learning in individuals with cerebral palsy (CP). For this reason 22 boy students with CP type I (12.26 ± 3.11 years of age) were chosen. They were put into self-control feedback, instructor-control feedback and control groups. All participants practiced dart throwing skill for 5 sessions (4 blocks of 5 trials each session). The self-control group received knowledge of results (KR) feedback for half of their trials whenever they wanted. The instructor-control group received KR feedback after half of both their good and bad trails. The control group received no feedback for any trails. The acquisition test was run immediately at the end of each practice session (the last block) and the retention and transfer

tests were run 24h following the acquisition phase. Analyses of variance with repeated measures and Post hoc tests were used to analyze the data. According to the results of this study, individuals with CP have the ability of acquiring and retaining a new motor skill. Also, it was found that self-control feedback is effective than instructor-control feedback on learning of a motor task in individuals with CP as in the average population. These findings show that rules regarding feedback also apply to people afflicted with CP.

Copyright © 2014 Elsevier Ltd. All rights reserved.

PMID: 25086427 [PubMed - indexed for MEDLINE]

Traitement - Rééducation motrice et cognitive

Pharmacologie Efficacite Tolérance

A clinically relevant BTX-A injection protocol leads to persistent weakness, contractile material loss, and an altered mRNA expression phenotype in rabbit quadriceps muscles.

Fortuna R, Vaz MA, Sawatsky A, Hart DA, Herzog W.

J Biomech. 2015 Jul 16;48(10):1700-6. doi: 10.1016/j.jbiomech.2015.05.018. Epub 2015 Jun 5.

Botulinum toxin type-A (BTX-A) injections have become a common treatment modality for patients suffering from muscle spasticity. Despite its benefits, BTX-A treatments have been associated with adverse effects on target muscles. Currently, application of BTX-A is largely based on clinical experience, and research quantifying muscle structure following BTX-A treatment has not been performed systematically. The purpose of this study was to evaluate strength, muscle mass, and contractile material six months following a single or repeated (2 and 3) BTX-A injections into the quadriceps femoris of New Zealand white rabbits. Twenty three skeletally mature rabbits were divided into four groups: experimental group rabbits received 1, 2, or 3 injections at intervals of 3 months (1-BTX-A, 2-BTX-A, 3-BTX-A, respectively) while control group rabbits received volume-matched saline injections. Knee extensor strength, quadriceps muscle mass, and quadriceps contractile material of the experimental group rabbits were expressed as a percentage change relative to the control group rabbits. One-way ANOVA was used to determine group differences in outcome measures ($\alpha=0.05$). Muscle strength and contractile material were significantly reduced in experimental compared to control group rabbits but did not differ between experimental groups. Muscle mass was the same in experimental BTX-A and control group rabbits. We concluded from these results that muscle strength and contractile material do not fully recover within six months of BTX-A treatment.

Copyright © 2015 Elsevier Ltd. All rights reserved.

PMID: 26087882 [PubMed - indexed for MEDLINE]

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 016.

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.

PMCID: PMC4759702

PMID: 26924985 [PubMed]

Evaluation of group versus individual physiotherapy following lower limb intra-muscular Botulinum Toxin-Type A injections for ambulant children with cerebral palsy: A single-blind randomized comparison trial.

Thomas RE, Johnston LM, Sakzewski L, Kentish MJ, Boyd RN.

Res Dev Disabil. 2016 Mar 5;53-54:267-278. doi: 10.1016/j.ridd.2016.02.014. [Epub ahead of print]

This study aimed to evaluate efficacy of group (GRP) versus individual (IND) physiotherapy rehabilitation following lower limb intramuscular injections of Botulinum Toxin-Type A (BoNT-A) for ambulant children with cerebral palsy (CP). Following lower limb BoNT-A injections, 34 children were randomly allocated to GRP (n=17; mean age 7y8m SD 2.0; 13 males; Gross Motor Function Classification System (GMFCS) I=5, II=8, III=4) or IND physiotherapy (n=17; mean age 8y7m SD 2.0; 11 males; GMFCS I=9, II=5, III=3). Primary outcomes were the Canadian Occupational Performance Measure (COPM) and Edinburgh Visual Gait Score (EVGS) assessed at baseline, 10 and 26 weeks post intervention. There were no baseline differences between groups. GRP intervention had greater, but not clinically meaningful, improvement in COPM satisfaction (estimated mean difference EMD 1.7, 95% CI 0.4-3.1; p<0.01) at 26 weeks. Both groups demonstrated clinically significant improvements in COPM performance and satisfaction, but minimal change in quality of gait (EVGS). Six hours of direct physiotherapy (either GRP or IND) with an additional indirect dose (median 16 episodes) of individualized home programme activities following lower limb BoNT-A injections, however, was inadequate to drive clinically meaningful changes in lower limb motor outcomes.

Copyright © 2016 Elsevier Ltd. All rights reserved.

PMID: 26955912 [PubMed - as supplied by publisher]

Quantitative evaluation for spasticity of calf muscle after botulinum toxin injection in patients with cerebral palsy: a pilot study.

Lin YC, Lin IL, Chou TF, Lee HM.

J Neuroeng Rehabil. 2016 Mar 12;13(1):25. doi: 10.1186/s12984-016-0135-8.

BACKGROUND: Cerebral palsy (CP) is the most common pediatric disease to cause motor disability. Two common symptoms in CP are spasticity and contracture. If this occurred in the ankle plantar flexors of children with CP, it will impair their gait and active daily living profoundly. Most children with CP receive botulinum toxin type A (BoNT-A) injection to reduce muscle tone, but a knowledge gap exists in the understanding of changes of neural and non-neural components of spasticity after injection. The purpose of this study was to determine if our device for quantitative modified Tardieu approach (QMTA) is a valid method to assess spasticity of calf muscles after botulinum toxin injection.

METHODS: In this study, we intended to develop a device for quantitative measurement of spasticity in calf muscles based on the modified Tardieu scale (MTS) and techniques of biomedical engineering. Our QMTA measures the angular displacement and resistance of stretched joint with a device that is light, portable and can be operated similar to conventional approaches for MTS. The static (R2), dynamic (R1) and R2-R1 angles derived from the reactive signals collected by the miniature sensors are used to represent the non-neural and neural components of stretched spastic muscles. Four children with CP were recruited to assess the change in spasticity in their gastrocnemius muscles before and 4 weeks after BoNT-A injection.

RESULTS: A simulated ankle model validated the performance of our device in measuring joint displacement and estimating the angle of catch. Data from our participants with CP showed that R2 and R2-R1 improved significantly after BoNT-A administration. It indicates both neural and non-neural components of the spastic gastrocnemius muscles improved at four weeks after BoNT-A injection in children with CP.

CONCLUSION: Our device for QMTA can objectively measure the changes in spasticity of the gastrocnemius muscle in children with cerebral palsy after BoNT-A injection.

[Free PMC Article](#)

PMCID: PMC4788868

PMID: 26969526 [PubMed - in process]

The effect of intrathecal baclofen treatment on activities of daily life in children and young adults with cerebral palsy and progressive neurological disorders.

Bonouvrié L, Becher J, Soudant D, Buizer A, van Ouwerkerk W, Vles G, Vermeulen RJ.

Eur J Paediatr Neurol. 2016 Mar 3. pii: S1090-3798(16)00046-5. doi:10.1016/j.ejpn.2016.02.013. [Epub ahead of print]

INTRODUCTION: Intrathecal baclofen (ITB) treatment is applied in patients with spastic cerebral palsy (SCP), dystonic cerebral palsy (DCP) and progressive neurological disease (PND). Our aim was to investigate whether ITB treatment has a different effect on activities of daily life (ADL) in these groups.

METHOD: A retrospective and cross-sectional survey was conducted using a questionnaire to assess the qualitative effect of ITB (Likert scale) on different domains of functioning (mobility, personal care, communication, comfort) and satisfaction with the results. Groups were compared using non-parametric statistics.

Science Infos Paralyse Cérébrale , mars 2016, **FONDATION MOTRICE** 67 rue Vergniaud 75013 Paris - tel +33 32 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

RESULTS: Questionnaires were completed for 68 patients (39 SCP, 13 DCP, 16 PND). Satisfaction scores were relatively high in all groups (7-8) and the positive effect on personal care and communication was similar in all groups. The PND group had the shortest follow-up and scored significantly less favourably for the effect on mobility and comfort.

DISCUSSION: This is the first study to show that ITB treatment has similar effects on personal care and communication in stable and progressive neurological disease. The decrease in mobility in the PND group is likely due to the progressive nature of the disease. The different effect on comfort between groups is mainly due to the smaller effect on startles in the PND group.

Copyright © 2016 European Paediatric Neurology Society. Published by Elsevier Ltd. All rights reserved.

PMID: 26995704 [PubMed - as supplied by publisher]

Chirurgie

Changes in hip geometry after selective dorsal rhizotomy in children with cerebral palsy.

Floeter N, Lebek S, Bakir MS, Sarpong A, Wagner C, Haberl EJ, Funk JF.

Hip Int. 2014 Dec 5;24(6):638-43. doi: 10.5301/hipint.5000142. Epub 2014 May 23.

PURPOSE: Hip development in children with spastic cerebral palsy (CP) may be different in comparison to that of typical developing children due to impaired motor function and altered lever arms. Selective dorsal rhizotomy (SDR) is known to reduce spasticity. It is postulated that it also improves mobility. Its influence on hip development is unclear. The aim of this study is to evaluate changes in hip geometry before and after selective dorsal rhizotomy.

METHODS: Conventional radiographs (Rippstein I and II) of 33 ambulatory children aged 2.67 to 11.75 years who underwent SDR were analysed pre- and postoperatively at a mean of 18 months (range 12-29 months). Migration percentage, acetabular index, and anteversion were evaluated. The reduction of spasticity was measured with the modified Ashworth scale. A priori power analysis was performed. As data was normally distributed statistical analysis was performed applying the t-test for paired variables.

RESULTS: Radiographic parameters concerning hip geometry improved significantly after SDR. The spasticity of adductors and hamstrings was significantly reduced through SDR from on average 1.7 to 0.8 on the modified Ashworth scale ($p < 0.001$). The acetabular index decreased from 19° to 17° ($p = 0.001$), the migration percentage improved from 24% to 21% ($p < 0.001$). Anteversion was also significantly reduced from 41° to 38° ($p < 0.001$). Function improved significantly from 80% to 85% when measured with the GMFM-88 ($p < 0.001$).

CONCLUSIONS: The results confirm that SDR improves hip geometry as well as function in ambulatory CP children. Long-term studies need to show whether this radiographic improvement has clinical relevance with regard to pain and function.

PMID: 24970326 [PubMed - indexed for MEDLINE]

Does rectus femoris transfer increase knee flexion during stance phase in Cerebral palsy?

de Moraes MC Filho(1), Blumetti FC(2), Kawamura CM(2), Lopes JA(3), Neves DL(3), Cardoso MO(2).

Acta Ortop Bras. 2016 Jan-Feb;24(1):27-31.

OBJECTIVE: To evaluate whether distal rectus femoris transfer (DRFT) is related to postoperative increase of knee flexion during the stance phase in cerebral palsy (CP).

METHODS: The inclusion criteria were Gross Motor Function Classification System (GMFCS) levels I-III, kinematic criteria for stiff-knee gait at baseline, and individuals who underwent orthopaedic surgery and had gait analyses performed before and after intervention. The patients included were divided into the following two groups: NO-DRFT (133 patients), which included patients who underwent orthopaedic surgery without DRFT, and DRFT (83 patients), which included patients who underwent orthopaedic surgery that included DRFT. The primary outcome was to evaluate in each group if minimum knee flexion in stance phase (FMJFA) changed after treatment.

RESULTS: The mean FMJFA increased from 13.19° to 16.74° ($p = 0.003$) and from 10.60° to 14.80° ($p = 0.001$) in Groups NO-DRFT and DRFT, respectively. The post-operative FMJFA was similar between groups NO-DRFT and DRFT ($p = 0.534$). The increase of FMJFA during the second exam (from 13.01° to 22.51°) was higher among the GMFCS III patients in the DRFT group ($p < 0.001$).

CONCLUSION: In this study, DRFT did not generate additional increase of knee flexion during stance phase when compared to the control group. Level of Evidence III, Retrospective Comparative Study.

[Free PMC Article](#)

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

PMCID: PMC4775485

PMID: 26997910 [PubMed - as supplied by publisher]

Inter-observer and intra-observer reliability in the radiographic diagnosis of avascular necrosis of the femoral head following reconstructive hip surgery in children with cerebral palsy.

Hesketh K, Sankar W, Joseph B, Narayanan U, Mulpuri K.

J Child Orthop. 2016 Mar 14. [Epub ahead of print]

PURPOSE: The incidence of avascular necrosis (AVN) following reconstructive hip surgery in cerebral palsy (CP) ranges from 0 to 69 % in the current literature. The purpose of this study was to determine the inter- and intra-observer reliability of radiographically diagnosing AVN in children with CP after hip surgery.

METHODS: A retrospective review of 65 children with CP who had reconstructive hip surgery between 2009 and 2012 at BC Children's Hospital was completed. Anterior-posterior and lateral radiographs were presented to four pediatric orthopaedic surgeons over two rounds. Surgeons were asked to review the set of unidentified radiographs and comment 'yes' or 'no' for the presence of AVN. Two weeks later the same set of radiographs was sent in a different order and the surgeons were again asked to comment on AVN. Inter- and intra-observer reliability was determined using kappa statistics.

RESULTS: The intra-observer reliability ranged from 0.65 to 0.88 with an average score of 0.76. Inter-observer reliability showed greater variability, ranging from 0.41 to 0.77 with an average score of 0.56 across all surgeons.

CONCLUSIONS: Although the intra-rater reliability produced a strength of "good" and the inter-rater reliability a strength of "moderate" agreement, the variability within these scores is clinically important as it demonstrates the difficulty in identifying AVN. This may explain the variability in AVN that is reported in the literature. The need for further education and research in the diagnosis of AVN in children with CP who have undergone reconstructive hip surgery is clinically necessary.

PMID: 26972813 [PubMed - as supplied by publisher]

Long-Term Results of Bilateral Medial Rectus Muscle Recession in Children with Developmental Delay.

Zehavi-Dorin T, Ben-Zion I, Mezer E, Wygnanski-Jaffe T.

Strabismus. 2016 Mar 8:1-5. [Epub ahead of print]

PURPOSE: To assess the long-term results of a reduced amount of medial rectus recession in children with esotropia and developmental delay.

METHODS: A retrospective chart analysis of 42 children with developmental delay who had undergone surgery for esotropia during a 20-year period in a large referral center was performed. The pre- and postoperative angle of deviation was calculated for each subject as the mean of distant and near angles measured by a cover test or the Krimsky measurement. Surgical success was categorized as esotropia or exotropia of ≤ 10 prism diopters (PD). The main outcome measure was a stable surgical result after several years of follow-up.

RESULTS: The chart review identified 42 children who met inclusion criteria, with a mean age of 2.9 years (range, 0.8-10 years). The mean angle of esotropia prior to surgery was 44.29 ± 13.9 PD (range 20-80 PD). All patients had bilateral medial rectus muscle recessions, with a mean surgical dosage of 5.04 ± 0.62 mm per muscle, on average 0.66 mm less than the standard amount. The average postoperative follow-up was 4.6 years (median 3.67 years, range 8 months-15 years). Twenty-four children (57%) achieved surgical success, 13 (31%) were undercorrected, and 5 (12%) were overcorrected. Ten of the 18 with an unsuccessful surgical outcome underwent a second procedure. The overall surgical success rate for all patients after all procedures was 71%.

CONCLUSIONS: The main reason for surgical failure after bilateral medial rectus muscle recession (BMR) in developmentally delayed children remains residual esotropia. However, with time, more patients demonstrated consecutive exotropia. Although it is difficult to achieve a stable long-term ocular alignment in children with developmental delay, satisfactory results may be achieved with additional surgical procedures. The optimal amount of primary recession and whether to perform the surgical schedules according to the Parks tables or to reduce the amount of the recession when operating on children with developmental delay is still debatable.

PMID: 26954620 [PubMed - as supplied by publisher]

Nerve endings and vascular supply in semitendinosus tendon of cerebral palsy Children.

Grzegorzewski A(1), Synder M(1), Modrzewski T(2), Drobniowski M(1), Polgaj M(3), Sibiński M(1).

Acta Ortop Bras. 2015 Sep-Oct;23(5):259-62. doi: 10.1590/1413-785220152305142813.

Science Infos Paralyse Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org 34

OBJECTIVE: To evaluate the distribution of SP (substance P) and S-100 peptide immunoreactivity, as well as the vascular supply of tissues commonly used as grafts for anterior cruciate ligament (ACL) reconstruction. A second aim was to compare the above mentioned distribution in the semitendinosus muscle tendons of cerebral palsy (CP) patients with the semitendinosus muscle tendons and patellar tendons of patients without CP.

METHODS: The first group consisted of 14 children with cerebral palsy with a mean age of 11.7 years old. At the time of hamstring lengthening operation, a sample of semitendinosus muscle was taken for analysis. The second group comprised 20 patients treated for isolated ACL rupture of the knee (mean age 32 years old). Group three comprised ten patients in the mean age of 14.3 years old treated for recurrent lateral patellar dislocation, and from whom a sample of patellar tendon was obtained.

RESULTS: No statistically significant differences were demonstrated with regard to the amount of immunopositive nerve fibers expressing SP or S-100 in all 3 groups of patients. A significant difference was noted in the number of blood vessels between the adult and child semitendinosus muscles, but not between the semitendinosus muscles and patellar tendon of children.

CONCLUSION: The number of nociceptors as well as proprioceptive fibers is similar in patients with CP and patients from a neurologically healthy population.

Level of Evidence IV, Cases Series.

[Free PMC Article](#)

PMCID: PMC4775478

PMID: 26981034 [PubMed]

The results of surgical treatment for pronation deformities of the forearm in cerebral palsy after a mean follow-up of 17.5 years.

Čobeljić G, Rajković S, Bajin Z, Lešić A, Bumbaširević M, Aleksić M, Atkinson HD.

J Orthop Surg Res. 2015 Jul 8;10:106. doi: 10.1186/s13018-015-0251-3.

AIM: This study evaluates the effects of three surgical procedures in the treatment of pronation deformities of the forearm in cerebral palsy patients; namely the transposition of pronator teres to extensor carpi radialis brevis muscle; and rerouting of the pronator teres muscle with or without pronator quadratus muscle myotomy.

METHODS: Sixty-one patients, 48 male/13 female, with a mean age of 17 years (5-41 years) were treated between 1971 and 2011. Pronator teres transposition was performed in 10, pronator rerouting in 35, and pronator rerouting with pronator quadratus myotomy in 16 patients. Ranges of motion, and assessments using the Quick Dash, Mayo Scoring, and Functional Classification system of upper extremity, were made before and after surgery. Mean follow-up was 17.5 years (3-41 years).

RESULTS: All three procedures led to significantly improved ranges of motion and upper limb function, with good/excellent results in 80 % of patients. Mean active supination improved from 10 ° (0-60 °) to 85 ° (30-90 °) ($p < 0.001$). There were significant improvements in Functional Classification system for the upper extremity scores ($p < 0.003$), Mean Quick Dash Scores improved from 58.41 (38.63-79.54) to 44.59 (27.27-68.18), and mean MEPS improved from 68 (30-85) to 84 (60-100) following surgery. All three techniques had statistically improved MEPS following surgery ($p < 0.001$); only the pronator teres muscle rerouting with pronator quadratus myotomy showed an improved Functional Classification system for the upper extremity score ($p < 0.05$); and only the pronator teres rerouting procedure showed an improved Quick Dash score ($p < 0.05$). There were no statistically significant differences in outcomes between different ages groups, and no significant differences between isolated pronator teres muscle rerouting were compared with those undergoing simultaneous treatment of carpal flexion and thumb adduction deformities ($p > 0.05$).

CONCLUSION: Surgery is very effective in the management of pronation deformities of the forearm in patients with cerebral palsy. Isolated pronator teres rerouting is probably the most effective and simple technique. Adjunctive pronator quadratus myotomy does not lead to an improvement in the results and requires an additional surgical approach. There should be no age restriction to surgery, as all age groups appear to benefit from similar improvements in range of motion and upper limb function.

PMCID: PMC4495804

PMID: 26152666 [PubMed - indexed for MEDLINE]

The split anterior tibialis tendon transfer procedure for spastic equinovarus foot in children with cerebral palsy: results and factors associated with a failed outcome.

Science Infos Paralyse Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 35 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

Int Orthop. 2015 Aug;39(8):1593-8. doi: 10.1007/s00264-015-2793-8. Epub 2015 May 7.
Limpaphayom N, Chantarasongsuk B, Osateerakun P, Prasongchin P.

PURPOSE: The aims of the study were to evaluate the outcomes and predictive factors of the split anterior tibialis tendon transfer (SPLATT) procedure for the treatment of the spastic equinovarus deformity in children with cerebral palsy (CCP).

METHODS: Forty-five ambulatory CCP with 68 equinovarus feet, positive for the flexor withdrawal reflex test, aged 8.1 ± 2.5 (range four to 15) years were enrolled. All feet underwent a soft tissue release procedure combined with the SPLATT procedure and were followed for at least 12 months after surgery. The functional outcome was rated using the criteria of Kling and co-workers. Pre-treatment gross motor functional classification system (GMFCS) levels were compared to the patients' latest evaluations. Factors associated with outcomes and success rate were assessed.

RESULTS: At an average follow-up of 5.5 ± 3.3 (range 1.1-16) years, feet were rated as excellent in 48 cases (70 %), good in ten (15 %) and poor in ten (15 %), respectively. Thirty-four CCP showed an improvement for the GMFCS level, $P < 0.001$. The factor that could predict a poor outcome was the pre-treatment GMFCS levels 3-4 with an odds ratio (95 % CI) of 4.92 (0.96-25.2), $P = 0.03$. The ten years success rate of the SPLATT procedure between CCP with GMFCS levels 1-2 and levels 3-4 were not different with a mean \pm SD (95 % CI) of 0.85 ± 0.1 (0.5-0.96) versus 0.6 ± 0.1 (0.3-0.8), $P = 0.08$, respectively.

CONCLUSIONS: The SPLATT procedure provides a balanced function of the foot, thus improving the ambulatory ability in CCP and should be integrated into the surgical plan. Pre-treatment GMFCS levels 3-4 predicted unfavourable outcomes and should be addressed during pre-operative parental counselling.

PMID: 25947903 [PubMed - indexed for MEDLINE]

Réadaptation fonctionnelle

Biomechanical and perceived differences between overground and treadmill walking in children with cerebral palsy.

Jung T, Kim Y, Kelly LE, Abel MF.

Gait Posture. 2016 Mar;45:1-6. doi: 10.1016/j.gaitpost.2015.12.004. Epub 2015 Dec 29.

The treadmill is widely used as an instrument for gait training and analysis. The primary purpose of this study was to compare biomechanical variables between overground and treadmill walking in children with cerebral palsy (CP). Perceived differences between the two walking modes were also investigated by comparing self-selected walking speeds. Twenty children with CP performed both overground and treadmill walking at a matched speed for biomechanical comparison using a 3-D motion analysis system. In addition, they were asked to select comfortable and fastest walking speeds under each walking condition to compare perceived differences. Significant differences in spatiotemporal variables were found including higher cadence and shorter stride length during treadmill walking at a matched speed (for all, $P < .003$). The comparison of joint kinematics demonstrated significant differences between overground and treadmill walking, which showed increases in peak angles of ankle dorsi-flexion, knee flexion/extension, and hip flexion (for all, $P < .001$), increases in ankle and hip excursions and a decrease in pelvic rotation excursion while walking on treadmill (for all, $P < .002$). Comparison of perceived difference revealed that children with CP chose significantly slower speeds when asked to select their comfortable and fastest walking speeds on the treadmill as compared to overground (for both, $P < .001$). Our results suggest that these biomechanical and perceived differences should be considered when using a treadmill for gait intervention or assessment.

Copyright © 2015 Elsevier B.V. All rights reserved.

PMID: 26979874 [PubMed - in process]

Effect of combining passive muscle stretching and whole body vibration on spasticity and physical performance of children and adolescents with cerebral palsy.

Tupimai T, Peungsuwan P, Prasertnoo J, Yamauchi J.

J Phys Ther Sci. 2016 Jan;28(1):7-13. doi: 10.1589/jpts.28.7. Epub 2016 Jan 30.

[Purpose] This study evaluated the immediate and short-term effects of a combination of prolonged passive muscle stretching (PMS) and whole body vibration (WBV) on the spasticity, strength and balance of children and adolescents with cerebral palsy.

Science Infos Paralyse Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 36 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

[Subjects and Methods] A randomized two-period crossover trial was designed. Twelve subjects with cerebral palsy aged 10.6 ± 2.4 years received both PMS alone as a control group (CG) and a combination of PMS and WBV as an experimental group (EG). After random allocation to the trial schedules of either EG-CG or CG-EG, CG received prolonged PMS while standing on a tilt-table for 40 minutes/day, and EG received prolonged PMS for 30 minutes, followed by 10 minutes WBV. Both CG and EG received the treatment 5 days/week for 6 weeks.

[Results] Immediately after one treatment, EG resulted in better improvement in scores on the Modified Ashworth Scale than CG. After the 6-week intervention, EG also showed significantly decreased scores on the Modified Ashworth Scale compared to CG. Both CG and EG showed significantly reduced the performance times in the five times sit to stand test, and EG also showed significantly increased scores on the pediatric balance scale.

[Conclusion] This study showed that 6 weeks of combined prolonged PMS and WBV had beneficial effects on the spasticity, muscle strength and balance of children and adolescents with CP.

[Free PMC Article](#)

PMCID: PMC4755966

PMID: 26957720 [PubMed]

Effects of whole-body vibration training on physical function, bone and muscle mass in adolescents and young adults with cerebral palsy.

Gusso S, Munns CF, Colle P, Derraik JG, Biggs JB, Cutfield WS, Hofman PL.

Sci Rep. 2016 Mar 3;6:22518. doi: 10.1038/srep22518.

We performed a clinical trial on the effects of whole-body vibration training (WBVT) on muscle function and bone health of adolescents and young adults with cerebral palsy. Forty participants (11.3-20.8 years) with mild to moderate cerebral palsy (GMFCS II-III) underwent 20-week WBVT on a vibration plate for 9 minutes/day 4 times/week at 20 Hz (without controls). Assessments included 6-minute walk test, whole-body DXA, lower leg pQCT scans, and muscle function (force plate). Twenty weeks of WBVT were associated with increased lean mass in the total body (+770 g; $p = 0.0003$), trunk (+410 g; $p = 0.004$), and lower limbs (+240 g; $p = 0.012$). Bone mineral content increased in total body (+48 g; $p = 0.0001$), lumbar spine (+2.7 g; $p = 0.0003$), and lower limbs (+13 g; $p < 0.0001$). Similarly, bone mineral density increased in total body (+0.008 g/cm²; $p = 0.013$), lumbar spine (+0.014 g/cm²; $p = 0.003$), and lower limbs (+0.023 g/cm²; $p < 0.0001$). Participants reduced the time taken to perform the chair test, and improved the distance walked in the 6-minute walk test by 11% and 35% for those with GMFCS II and III, respectively. WBVT was associated with increases in muscle mass and bone mass and density, and improved mobility of adolescents and young adults with cerebral palsy.

[Free PMC Article](#)

PMCID: PMC4776132

PMID: 26936535 [PubMed - in process]

Gaze-based assistive technology in daily activities in children with severe physical impairments-An intervention study.

Borgestig M, Sandqvist J, Ahlsten G, Falkmer T, Hemmingsson H.

Dev Neurorehabil. 2016 Mar 1:1-13. [Epub ahead of print]

OBJECTIVE: To establish the impact of a gaze-based assistive technology (AT) intervention on activity repertoire, autonomous use, and goal attainment in children with severe physical impairments, and to examine parents' satisfaction with the gaze-based AT and with services related to the gaze-based AT intervention.

METHODS: Non-experimental multiple case study with before, after, and follow-up design. Ten children with severe physical impairments without speaking ability (aged 1-15 years) participated in gaze-based AT intervention for 9-10 months, during which period the gaze-based AT was implemented in daily activities.

RESULTS: Repertoire of computer activities increased for seven children. All children had sustained usage of gaze-based AT in daily activities at follow-up, all had attained goals, and parents' satisfaction with the AT and with services was high.

DISCUSSION: The gaze-based AT intervention was effective in guiding parents and teachers to continue supporting the children to perform activities with the AT after the intervention program.

PMID: 26930111 [PubMed - as supplied by publisher]

Gait Training and Ankle Dorsiflexors in Cerebral Palsy.

Millichap JG(1).

Pediatr Neurol Briefs. 2015 Mar;29(3):22. doi: 10.15844/pedneurbriefs-29-3-5.

Investigators at University of Copenhagen, Denmark, evaluated whether 4 weeks of 30 min daily treadmill training with an incline may facilitate corticospinal transmission and improve control of the ankle joint in 16 children, aged 5-14 years, with cerebral palsy.

PMCID: PMC4747261

PMID: 26933564 [PubMed]

[Free PMC Article](#)

Mastery motivation: a way of understanding therapy outcomes for children with unilateral cerebral palsy.

Miller L, Ziviani J, Ware RS, Boyd RN.

Disabil Rehabil. 2015;37(16):1439-45. doi: 10.3109/09638288.2014.964375. Epub 2014 Sep 26.

PURPOSE: To investigate the impact of mastery motivation on occupational performance outcomes immediately following upper limb (UL) training and 6 months post-intervention for school-aged children with unilateral cerebral palsy.

METHOD: This prediction study was a post-hoc analysis of a matched pairs randomized comparison trial (COMBiT Trial Registration: ACTRN12613000181707). The Canadian Occupational Performance Measure (COPM) was administered at baseline, 13 and 26 weeks post-intervention. Parents completed the Dimensions of Mastery Questionnaire (DMQ), Parenting Scale and a demographic questionnaire. Children's UL capacity and performance was assessed using the Melbourne Assessment of Unilateral UL Function and assisting hand assessment (AHA). Regression models were fitted using generalized estimating equations to baseline, 13 and 26 week measurements.

RESULTS: Forty-six children (7.78 years SD 2.27 years, 31 males, Manual Ability Classification System I = 23, II = 23) participated. Higher levels of bimanual performance (AHA: $\beta = 0.03$, $p < 0.001$), greater object-oriented persistence (DMQ: $\beta = 0.31$, $p = 0.05$), and treatment group allocation (Standard Care: $\beta = 0.24$, $p = 0.01$) were positively associated with COPM performance scores post-intervention.

CONCLUSIONS: Children's bimanual performance and persistence with object-oriented tasks significantly impact occupational performance outcomes following UL training. Predetermining children's mastery motivation along with bimanual ability may assist in tailoring of intervention strategies and models of service delivery to improve effectiveness. Implications for Rehabilitation Children's object persistence and bimanual performance both impact upper limb training outcomes Working with children's motivational predispositions may optimize engagement and therapy outcomes. Supporting positive parenting styles may enhance a child's mastery motivation and persistence with difficult tasks.

PMID: 25259559 [PubMed - indexed for MEDLINE]

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]

Treadmill Training with Virtual Reality Improves Gait, Balance, and Muscle Strength in Children with Cerebral Palsy.

Cho C, Hwang W, Hwang S, Chung Y.

Tohoku J Exp Med. 2016;238(3):213-8. doi: 10.1620/tjem.238.213.

Independent walking is an important goal of clinical and community-based rehabilitation for children with cerebral palsy (CP). Virtual reality-based rehabilitation therapy is effective in motivating children with CP. This study investigated the effects of treadmill training with virtual reality on gait, balance, muscular strength, and gross motor function in children with CP. Eighteen children with spastic CP were randomly divided into the virtual reality treadmill training (VRTT) group (9 subjects, mean age, 10.2 years) and treadmill training (TT) group (9 subjects, mean age, 9.4 years). The groups performed their respective programs as well as conventional physical therapy 3 times/week for 8 weeks. Muscle strength was assessed using a digitalized manual muscle tester. Gross motor function was assessed using the Gross Motor Functional Measure (GMFM). Balance was assessed using the Pediatric Balance Scale (PBS). Gait speed was assessed using the 10-meter walk test (10MWT), and gait endurance was assessed using the 2-minute walk test (2MWT). After training, gait and balance was improved in the VRTT compared to the TT group ($P < 0.05$). Muscular strength was significantly greater in the VRTT group than the TT group, except for right hamstring strength. The improvements in GMFM (standing) and PBS scores were greater in the VRTT group than the TT group ($P < 0.05$). Furthermore, the VRTT group showed the higher values of 10MWT and 2MWT compared to the TT group ($P < 0.05$). In conclusion, VRTT programs are effective for improving gait, balance, muscular strength, and gross motor function in children with CP.

PMID: 26947315 [PubMed - in process]

Rehabilitation and neuroplasticity in children with unilateral cerebral palsy.

Reid LB, Rose SE, Boyd RN.

Nat Rev Neurol. 2015 Jul;11(7):390-400. doi: 10.1038/nrneuro.2015.97. Epub 2015 Jun 16.

Cerebral palsy is a childhood-onset, lifelong neurological disorder that primarily impairs motor function. Unilateral cerebral palsy (UCP), which impairs use of one hand and perturbs bimanual co-ordination, is the most common form of the condition. The main contemporary upper limb rehabilitation strategies for UCP are constraint-induced movement therapy and bimanual intensive therapy. In this Review, we outline the factors that are crucial to the success of motor rehabilitation in children with UCP, including the dose of training, the relevance of training to daily life, the suitability of training to the age and goals of the child, and the ability of the child to maintain close attention to the tasks. Emerging evidence suggests that the first 2 years of life are a critical period during which interventions for UCP could be more effective than in later life. Abnormal brain organization in UCP, and the effects of development on rehabilitation, must also be understood to develop new effective interventions. Therefore, we also consider neuroimaging methods that can provide insight into the neurobiology of UCP and how the condition responds to existing therapies. We discuss how these methods could shape future rehabilitative strategies based on the neurobiology of UCP and the therapy-induced changes seen in the brain.

PMID: 26077839 [PubMed - indexed for MEDLINE]

Stimulation cérébrale - Stimulation neurosensorielle

Cerebellar transcranial direct current stimulation in children with ataxic cerebral palsy: A sham-controlled, crossover, pilot study.

Grecco LA, Oliveira CS, Duarte NA, Lima VL, Zanon N, Fregni F.

Dev Neurorehabil. 2016 Mar 22:1-7. [Epub ahead of print]

OBJECTIVE: The aim of the present study was to analyze the use of anodal tDCS of the cerebellar region combined with treadmill training to improve balance and functional performance in children with ataxic cerebral palsy.

DESIGN: Single-blind, sham-controlled, crossover, pilot study.

SETTING: Rehabilitation center and research motion analysis laboratory.

PARTICIPANTS: Children (N = 6) with ataxic cerebral palsy and balance deficit.

MAIN OUTCOME MEASURES: Static balance (oscillations of the center of pressure), functional balance (Pediatric Balance Scale) and functional performance (Pediatric Evaluation of Disability Inventory) were evaluated.

RESULTS: Significant reductions occurred in oscillations of the center of pressure with eyes closed after active anodal tDCS only. The effects of treadmill training on functional balance and functional performance in mobility were maintained in the active tDCS group only.

CONCLUSION: These preliminary data support the notion that anodal tDCS of the cerebellar region combined with treadmill training improves balance in children with ataxic cerebral palsy.

PMID: 27003795 [PubMed - as supplied by publisher]

Deep anterior cerebellar stimulation reduces symptoms of secondary dystonia in patients with cerebral palsy treated due to spasticity.

Sokal P, Rudaś M, Harat M, Szyłberg Ł, Zieliński P.

Clin Neurol Neurosurg. 2015 Aug;135:62-8. doi: 10.1016/j.clineuro.2015.05.017. Epub 2015 May 23.

INTRODUCTION: Deep anterior cerebellar stimulation (DACS) is a neuromodulation therapy of spasticity. Bilateral DACS is applied in young patients with cerebral palsy (CP). In these patients symptoms of spasticity coexist with symptoms of focal or segmental dystonia, which can cause chronic pain. We performed the study to investigate the therapeutic effects of DACS in spasticity, secondary dystonia and pain.

METHODS: We examined 10 from 13 patients with CP treated with DACS due to spasticity in years 2006-2012. We compared Ashworth scores of spasticity, VAS scale of pain and UDRS (Unified Dystonia Rating Scale) score before DACS and after it in follow-up lasting from 2 to 11 years in these patients basing on clinical examination and evaluating forms given by the patients or parents.

RESULTS: We received statistically significant reduction of spasticity in upper extremities (median: from 3 to 1,5 in Ashworth scale) in 8 patients ($p = 0,01$), in lower extremities in 7 patients (median: from 3 to 1,75) ($p = 0,02$). Symptoms of focal dystonia were reduced. Total score for the UDRS (median = 18,0 before surgery) after DACS decreased significantly (median = 10,3) ($p = 0,043$). Change in consecutive parts of UDRS before (median = 1,6) and after (median = 1,0) surgery in 7 patients had statistical significance ($p = 0,0179$). There were not significant changes in intensity of pain before and after surgery ($p = 0,108$).

DISCUSSION: Chronic bilateral DACS aimed for spasticity treatment not only decreases muscular tone in quadriplegic or paraplegic patients with CP but also is associated with reduction of symptoms of focal or segmental, secondary dystonia.

Copyright © 2015 Elsevier B.V. All rights reserved.

PMID: 26038278 [PubMed - indexed for MEDLINE]

Effect of r-TMS over standard therapy in decreasing muscle tone of spastic cerebral palsy patients.

Gupta M, Lal Rajak B, Bhatia D, Mukherjee A.

J Med Eng Technol. 2016 Mar 24:1-7. [Epub ahead of print]

Spastic cerebral palsy (CP) is the one of most common neurological disorders occurring due to damage to the immature brain or any other brain lesion at the time of birth. To aid in making the life of the CP patient meaningful, several interventions such as medical, surgical and rehabilitation have been employed to date. Besides these, recently repetitive Transcranial magnetic stimulation (r-TMS) is a new found approach which is being employed for treating various neurological and psychological conditions. The aim of this study was to observe the effects of r-TMS on muscle spasticity in CP patients by stimulating the motor cortex area of the brain, which is responsible for muscle movements. In this study, 20 subjects diagnosed with CP were recruited and 10 each were placed in two groups, namely the research group (RG) (mean age, height and weight were 7.99 (SD = 4.66) years, 116.7 (SD = 23.57) cm and 21.40 (SD = 10.95) kg, respectively) and the control group (CG) (mean age, height and weight were 8.41 (SD = 4.32) years, 107.9 (SD = 26.33) cm, 21.40 (SD = 12.63) kg, respectively). r-TMS frequencies of 5 Hz and 10 Hz were administered for 15 min daily to patients in RG followed by standard therapy (ST) of 1 h duration daily for 20 days. Moreover, the patients in the control group (CG) were given only standard therapy (ST) of 1 h duration for 20 days. Modified Ashworth Scale (MAS) was used as an outcome measure to determine the level of muscle spasticity. A pre- assessment of MAS score was performed on both RG and CG to determine the level of spasticity prior to starting therapy; and similarly post-assessment after 20 days was done to observe the changes post-therapy. Statistical analysis of pre vs post MAS scores showed that few muscles showed reduction in muscle tightness after administering only ST in the CG. On the contrary, the RG that underwent r-TMS therapy combined with ST showed a significant decrease ($p < 0.05$) in muscle tightness for all the muscle selected for the therapy.

PMID: 27010377 [PubMed - as supplied by publisher]

Science Infos Paralyse Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 40 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

Transcranial direct current stimulation during treadmill training in children with cerebral palsy: a randomized controlled double-blind clinical trial.

Grecco LA, de Almeida Carvalho Duarte N, Mendonça ME, Cimolin V, Galli M, Fregni F, Santos Oliveira C.
Res Dev Disabil. 2014 Nov;35(11):2840-8. doi: 10.1016/j.ridd.2014.07.030. Epub 2014 Aug 6.

Impaired gait constitutes an important functional limitation in children with cerebral palsy (CP). Treadmill training has achieved encouraging results regarding improvements in the gait pattern of this population. Moreover, transcranial direct current stimulation (tDCS) is believed to potentiate the results achieved during the motor rehabilitation process. The aim of the present study was to determine the effect of the administration of tDCS during treadmill training on the gait pattern of children with spastic diparetic CP. A double-blind randomized controlled trial was carried out involving 24 children with CP allocated to either an experimental group (active anodal tDCS [1mA] over the primary motor cortex of the dominant hemisphere) or control group (placebo tDCS) during ten 20-min sessions of treadmill training. The experimental group exhibited improvements in temporal functional mobility, gait variables (spatiotemporal and kinematics variables). The results were maintained one month after the end of the intervention. There was a significant change in corticospinal excitability as compared to control group. In the present study, the administration of tDCS during treadmill training potentiated the effects of motor training in children with spastic diparetic CP.

Copyright © 2014 Elsevier Ltd. All rights reserved.

PMID: 25105567 [PubMed - indexed for MEDLINE]

Réalité virtuelle - Jeux video

Preparing a neuropediatric upper limb exergame rehabilitation system for home-use: a feasibility study.

Gerber CN, Kunz B, van Hedel HJ

J Neuroeng Rehabil. 2016 Mar 23;13(1):33. doi: 10.1186/s12984-016-0141-x.

BACKGROUND: Home-based, computer-enhanced therapy of hand and arm function can complement conventional interventions and increase the amount and intensity of training, without interfering too much with family routines. The objective of the present study was to investigate the feasibility and usability of the new portable version of the YouGrabber® system (YouRehab AG, Zurich, Switzerland) in the home setting.

METHODS: Fifteen families of children (7 girls, mean age: 11.3y) with neuromotor disorders and affected upper limbs participated. They received instructions and took the system home to train for 2 weeks. After returning it, they answered questions about usability, motivation, and their general opinion of the system (Visual Analogue Scale; 0 indicating worst score, 100 indicating best score; ≤30 not satisfied, 31-69 average, ≥70 satisfied). Furthermore, total pure playtime and number of training sessions were quantified. To prove the usability of the system, number and sort of support requests were logged.

RESULTS: The usability of the system was considered average to satisfying (mean 60.1-93.1). The lowest score was given for the occurrence of technical errors. Parents had to motivate their children to start (mean 66.5) and continue (mean 68.5) with the training. But in general, parents estimated the therapeutic benefit as high (mean 73.1) and the whole system as very good (mean 87.4). Children played on average 7 times during the 2 weeks; total pure playtime was 185 ± 45 min. Especially at the beginning of the trial, systems were very error-prone. Fortunately, we, or the company, solved most problems before the patients took the systems home. Nevertheless, 10 of 15 families contacted us at least once because of technical problems.

CONCLUSIONS: Despite that the YouGrabber® is a promising and highly accepted training tool for home-use, currently, it is still error-prone, and the requested support exceeds the support that can be provided by clinical therapists. A technically more robust system, combined with additional attractive games, likely results in higher patient motivation and better compliance. This would reduce the need for parents to motivate their children extrinsically and allow for clinical trials to investigate the effectiveness of the system.

TRIAL REGISTRATION: ClinicalTrials.gov NCT02368223.

Free PMC Article

PMCID: PMC4806437

PMID: 27008504 [PubMed - in process]

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]

Treadmill Training with Virtual Reality Improves Gait, Balance, and Muscle Strength in Children with Cerebral Palsy.

Cho C, Hwang W, Hwang S, Chung Y.

Tohoku J Exp Med. 2016;238(3):213-8. doi: 10.1620/tjem.238.213.

Independent walking is an important goal of clinical and community-based rehabilitation for children with cerebral palsy (CP). Virtual reality-based rehabilitation therapy is effective in motivating children with CP. This study investigated the effects of treadmill training with virtual reality on gait, balance, muscular strength, and gross motor function in children with CP. Eighteen children with spastic CP were randomly divided into the virtual reality treadmill training (VRTT) group (9 subjects, mean age, 10.2 years) and treadmill training (TT) group (9 subjects, mean age, 9.4 years). The groups performed their respective programs as well as conventional physical therapy 3 times/week for 8 weeks. Muscle strength was assessed using a digitalized manual muscle tester. Gross motor function was assessed using the Gross Motor Functional Measure (GMFM). Balance was assessed using the Pediatric Balance Scale (PBS). Gait speed was assessed using the 10-meter walk test (10MWT), and gait endurance was assessed using the 2-minute walk test (2MWT). After training, gait and balance was improved in the VRTT compared to the TT group ($P < 0.05$). Muscular strength was significantly greater in the VRTT group than the TT group, except for right hamstring strength. The improvements in GMFM (standing) and PBS scores were greater in the VRTT group than the TT group ($P < 0.05$). Furthermore, the VRTT group showed the higher values of 10MWT and 2MWT compared to the TT group ($P < 0.05$). In conclusion, VRTT programs are effective for improving gait, balance, muscular strength, and gross motor function in children with CP.

[Free Article](#)

PMID: 26947315 [PubMed - in process]

Wrist range of motion and motion frequency during toy and game play with a joint-specific controller specially designed to provide neuromuscular therapy: A proof of concept study in typically developing children.

Science Infos Paralyisie Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 42 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

Crisco JJ, Schwartz JB, Wilcox B, Brideau H, Basseches B, Kerman K.
J Biomech. 2015 Aug 20;48(11):2844-8. doi: 10.1016/j.jbiomech.2015.04.018. Epub 2015 Apr 22.

Upper extremities affected by hemiplegic cerebral palsy (CP) and other neuromuscular disorders have been demonstrated to benefit from therapy, and the greater the duration of the therapy, the greater the benefit. A great motivator for participating in and extending the duration of therapy with children is play. Our focus is on active motion therapy of the wrist and forearm. In this study we examine the wrist motions associated with playing with two toys and three computer games controlled by a specially-designed play controller. Twenty children (ages 5-11) with no diagnosis of a muscular disorder were recruited. The play controller was fitted to the wrist and forearm of each child and used to measure and log wrist flexion and extension. Play activity and enjoyment were quantified by average wrist range of motion (ROM), motion frequency measures, and a discrete visual scale. We found significant differences in the average wrist ROM and motion frequency among the toys and games, yet there were no differences in the level of enjoyment across all toys and games, which was high. These findings indicate which toys and games may elicit the greater number of goal-directed movements, and lay the foundation for our long-term goal to develop and evaluate innovative motion-specific play controllers that are engaging rehabilitative devices for enhancing therapy and promoting neural plasticity and functional recovery in children with CP.

Copyright © 2015 Elsevier Ltd. All rights reserved.

PMCID: PMC4536107 [Available on 2016-08-20]

PMID: 25935686 [PubMed - indexed for MEDLINE]

Thérapie cellulaire Médecine régénérative

Effect of umbilical cord mesenchymal stromal cells on motor functions of identical twins with cerebral palsy: pilot study on the correlation of efficacy and hereditary factors.

Wang X, Hu H, Hua R, Yang J, Zheng P, Niu X, Cheng H, Dai G, Liu X, Zhang Z, An Y.

Cytotherapy. 2015 Feb;17(2):224-31. doi: 10.1016/j.jcyt.2014.09.010.

BACKGROUND AIMS: The objective of this study was to compare the impact of umbilical cord-derived mesenchymal stromal cell (UCMSC) transplantation on the motor functions of identical twins with cerebral palsy (CP) and to analyze the correlation between the efficacy and hereditary factors.

METHODS: Eight pairs (16 individuals) of identical twins with CP were recruited and received allogenic UCMSC transplantation by means of subarachnoid injection. The gross motor function measure (GMFM) and the fine motor function measure (FMFM) were performed before and 1 and 6 months after the treatment to analyze the results of individuals before and after the therapy, between two individuals of an identical twin and among twin pairs. Repeated-measured data variance was used to analyze the GMFM and FMFM scores of patients before and 1 and 6 months after the therapy.

RESULTS: Eight pairs (16 individuals) of children with CP had significant improvement in the GMFM at the end of the 1st and 6th months after the therapy compared with that before the therapy, whereas the amelioration of the FMFM was not statistically significant. The improvements in motor functions between two individuals of an identical twin but not among twin pairs were correlated.

CONCLUSIONS: UCMSC transplantation significantly improves GMFM in children with CP; motor function improvements in the GMFM between two individuals of an identical twin were closely correlated, but improvements among twin pairs were not correlated. We hypothesize that hereditary factors contribute to the mechanisms of UCMSC transplantation in motor function improvement in children with CP.

Copyright © 2015 International Society for Cellular Therapy. Published by

Elsevier Inc. All rights reserved.

PMID: 25593078 [PubMed - indexed for MEDLINE]

Intrathecal injection of CD133-positive enriched bone marrow progenitor cells in children with cerebral palsy: feasibility and safety.

Zali A, Arab L, Ashrafi F, Mardpour S, Niknejhadi M, Hedayati-Asl AA, Halimi-Asl A, Ommi D, Hosseini SE, Baharvand H, Aghdami N.

Cytotherapy. 2015 Feb;17(2):232-41. doi: 10.1016/j.jcyt.2014.10.011. Epub 2014 Nov 1.

BACKGROUND AIMS: Recent studies have proposed that cellular transplantation may have some regenerative and functional efficacy in the treatment of cerebral palsy (CP); however, much remains to be understood regarding its safety, feasibility and efficacy. This study was initiated to evaluate the safety of autologous bone marrow-derived CD133(+) cell intrathecal injection.

METHODS: Children (n = 12), aged 4 to 12 years, who were diagnosed with different types of CP underwent BM aspiration. CD133(+) cells were enriched from the BM samples and intrathecally injected. The Gross Motor Function Measure (GMFM-66), Gross Motor Function Classification System (GMFCS), UK FIM+FAM, Functional Independence Measure (FIM) and Functional Assessment Measure (FAM) were assessed at baseline and 6 months after the procedure. Patients' ability to balance was measured by the Berg Balance Scale (BBS), and severity of spasticity was evaluated by the Modified Ashworth Scale. Magnetic resonance imaging was done at baseline and 6 months after therapy. This study was registered in ClinicalTrials.gov (NCT01404663).

RESULTS: There were no adverse events detected by clinical and laboratory tests or imaging studies, with the exception of a seizure in 1 patient. A significant improvement was observed 6 months after cell transplantation versus baseline according to GMFM, GMFCS, FIM+FAM, Ashworth Scale, and BBS outcomes.

CONCLUSIONS: Subarachnoid injection of CD133-positive enriched bone marrow progenitor cells in children with CP is a safe approach. The results suggest a possible short-term improvement in neurological function.

Copyright © 2015 International Society for Cellular Therapy. Published by Elsevier Inc. All rights reserved.

PMID: 25593079 [PubMed - indexed for MEDLINE]

Stem cells therapy in cerebral palsy: A systematic review.

Kuřak-Bejda A, Kuřak P, Bejda G, Krajewska-Kuřak E, Kuřak W.

Brain Dev. 2016 Mar 18. pii: S0387-7604(16)30006-7. doi: 10.1016/j.braindev.2016.03.002. [Epub ahead of print]

The aim of this study was to systematically present the best available stem cell therapies for children with cerebral palsy (CP). The databases Medline, PubMed, EMBASE, and the Cochrane Controlled Trials Register for RCTs were searched for studies published from 1967 to August 2015. Systematic reviews, randomised controlled trials (RCTs), controlled trials, uncontrolled trials, cohort studies, open-label studies, and a meta-analysis were analysed. Of 360 articles, seven fulfilled the inclusion criteria: one RCT and six were open-label trials. In these studies, one application of stem cells for children with CP was typical, and the total number of cells administered to patients ranged from 10(6) to 10(8)/kg. Different routes of cell delivery were used, though in most studies motor development was applied as an indicator of primary outcomes. In three articles, neuroimaging studies were also implemented to confirm the efficacy of the therapies. Observation periods varied from 3months to 5years, and patients' tolerance of the therapy was generally good. Stem cell therapy may improve some symptoms in patients with CP, though larger studies are needed to examine the impact of stem cell therapy upon CP.

Copyright © 2016. Published by Elsevier B.V.

PMID: 27004672 [PubMed - as supplied by publisher]

Therapeutic potential of human embryonic stem cell transplantation in patients with cerebral palsy.

Shroff G, Gupta A, Barthakur JK.

J Transl Med. 2014 Dec 12;12:318. doi: 10.1186/s12967-014-0318-7.

BACKGROUND: The present study evaluated the efficacy and safety of human embryonic stem cell (hESC) therapy in patients with CP.

MATERIALS AND METHODS: This analysis included patients (30 days-18 yr) with documented diagnosis of CP. The study consisted of four treatment phases (T1, T2, T3, T4) separated by gap phases. Efficacy of hESC therapy was evaluated based on Gross Motor Function Classification Scores Expanded and Revised (GMFCS-E & R; 1-good to 5-bad).

RESULTS: Ninety one patients were included and all received hESC therapy in T1, 66 patients returned for T2, 38 patients for T3, and 15 patients for T4. Overall, 30.2% patients achieved GMFCS-E & R score 1 during the study with different number of patients achieving GMFCS score 1 by the end of each treatment phase (T1: 6 [6.6%]; T2: 7 [10.6%]; T3: 11 [28.9%]; and T4: 5 [33.3%]). All patients in up to 2 yr (n = 10), 2-4 yr (n = 10), 4-6 yr (n = 9), and 6-12 yr (n = 8) age groups except one of the 5 patients in the age group of 12-18 yr transitioned from GMFCS-E & R score 5 to lower scores by end of T1. Most patients transitioned to GMFCS-E & R score 2 (n = 34) from higher scores by end of T2. Eleven patients achieved GMFCS-E & R score 1 by end of T3. No serious adverse events were observed.

Science Infos Paralyse Cérébrale , mars 2016, **FONDATION MOTRICE** 67 rue Vergniaud 75013 Paris - tel +33 44 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

CONCLUSION: Use of hESC therapy in patients with CP is effective and safe. hESC therapy has demonstrated significant improvement in GMFCS-E & R scale.

PMCID: PMC4297392

PMID: 25496119 [PubMed - indexed for MEDLINE]

Unmasking the responses of the stem cells and progenitors in the subventricular zone after neonatal and pediatric brain injuries.

Clausi MG, Kumari E, Levison SW.

Neural Regen Res. 2016 Jan;11(1):45-8. doi: 10.4103/1673-5374.175041.

There is great interest in the regenerative potential of the neural stem cells and progenitors that populate the subventricular zone (SVZ). However, a comprehensive understanding of SVZ cell responses to brain injuries has been hindered by the lack of sensitive approaches to study the cellular composition of this niche. Here we review progress being made in deciphering the cells of the SVZ gleaned from the use of a recently designed flow cytometry panel that allows SVZ cells to be parsed into multiple subsets of progenitors as well as putative stem cells. We review how this approach has begun to unmask both the heterogeneity of SVZ cells as well as the dynamic shifts in cell populations with neonatal and pediatric brain injuries. We also discuss how flow cytometric analyses also have begun to reveal how specific cytokines, such as Leukemia inhibitory factor are coordinating SVZ responses to injury.

[Free PMC Article](#)

PMCID: PMC4774221

PMID: 26981076 [PubMed]

Exosquelette

Custom sizing of lower limb exoskeleton actuators using gait dynamic modelling of children with cerebral palsy.

Samadi B, Achiche S, Parent A, Ballaz L, Chouinard U, Raison M.

Comput Methods Biomech Biomed Engin. 2016 Mar 15:1-6. [Epub ahead of print]

The use of exoskeletons as an aid for people with musculoskeletal disorder is the subject to an increasing interest in the research community. These devices are expected to meet the specific needs of users, such as children with cerebral palsy (CP) who are considered a significant population in pediatric rehabilitation. Although these exoskeletons should be designed to ease the movement of people with physical shortcoming, their design is generally based on data obtained from healthy adults, which leads to oversized components that are inadequate to the targeted users. Consequently, the objective of this study is to custom-size the lower limb exoskeleton actuators based on dynamic modeling of the human body for children with CP on the basis of hip, knee, and ankle joint kinematics and dynamics of human body during gait. For this purpose, a multibody modeling of the human body of 3 typically developed children (TD) and 3 children with CP is used. The results show significant differences in gait patterns especially in knee and ankle with respectively 0.39 and -0.33 (Nm/kg) maximum torque differences between TD children and children with CP. This study provides the recommendations to support the design of actuators to normalize the movement of children with CP.

PMID: 26980164 [PubMed - as supplied by publisher]

Autres methodes

Effect of Hippotherapy on Motor Proficiency and Function in Children with Cerebral Palsy Who Walk.

Champagne D, Corriveau H, Dugas C.

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

AIMS: To evaluate the effects of hippotherapy on physical capacities of children with cerebral palsy.

METHODS: Thirteen children (4-12 years old) with cerebral palsy classified in Gross Motor Function Classification system Level I or II were included in this prospective quasi-experimental ABA design study. Participants received 10 weeks of hippotherapy (30 min per week). Gross motor function and proficiency were measured with the Bruininks-Oseretski Motor Proficiency short form [BOT2-SF]) and the Gross Motor Function Measure-88 [GMFM-88] Dimension D and E) twice before the program (T1 and T1'), immediately after (T2), and 10 weeks following the end

of the program (T3).

RESULTS: Mean scores for dimensions D and E of the GMFM-88 Dimension scores ($p = .005$) and three out of the eight items of the BOT2-SF (fine motor precision ($p = .013$), balance ($p = .025$), and strength ($p = .012$) improved between baseline and immediately after intervention; mean scores immediately following and 10 weeks following intervention did not differ.

CONCLUSIONS: Hippotherapy provided by a trained therapist who applies an intense and graded session for 10 weeks can improve body functions and performance of gross motor and fine motor activities in children with cerebral palsy.

PMID: 26930110 [PubMed - as supplied by publisher]

Douleur

Epidural Baclofen for the Management of Postoperative Pain in Children With Cerebral Palsy.

Nemeth BA(1), Montero RJ, Halanski MA, Noonan KJ.

J Pediatr Orthop. 2015 Sep;35(6):571-5. doi: 10.1097/BPO.0000000000000329.

INTRODUCTION: Children with cerebral palsy undergoing soft tissue and bony procedures often experience pain and spasticity postoperatively. Differentiation of pain from spasticity complicates management, so controlling spasticity with a continuous infusion of baclofen, an antispasmodic, through an already present indwelling epidural catheter holds interest.

METHODS: A retrospective chart review was performed of patients with cerebral palsy undergoing single event, multilevel lower extremity surgery at a single institution who received epidural analgesia with or without continuous baclofen infusion. Primary outcomes included need for supplemental narcotic analgesics and benzodiazepines postoperatively. Duration of hospitalization, pain scores, and complications were also evaluated.

RESULTS: Forty-four patients were identified, ranging in age from 3 to 17 years, 19 of whom received epidural baclofen. No differences were found in use of supplemental narcotic analgesia, benzodiazepines, or duration of hospitalization. Differences in pain scores were not statistically significant (0.82 ± 0.95 for baclofen vs. 1.48 ± 0.99 for controls) ($P=0.391$). Mean arterial pressure was lower in patients receiving baclofen ($P=0.004$). No potential side effects attributable to baclofen were noted.

CONCLUSIONS: Continuous epidural baclofen infusion seems unlikely to alter the pain-spasm cycle experienced by patients with cerebral palsy following orthopaedic surgery to a clinically significant degree. More effective, and cost-effective, measures at assessing and controlling pain and muscle spasm should be explored to benefit cerebral palsy patients postoperatively.

LEVEL OF EVIDENCE: Level III-therapeutic study.

PMID: 26251959 [PubMed - indexed for MEDLINE]

Fatigue

Focus on fatigue amongst young adults with spastic cerebral palsy.

Russchen HA, Slaman J, Stam HJ, van Markus-Doornbosch F, van den Berg-Emons RJ, Roebroek ME; LEARN 2 MOVE Research Group.

J Neuroeng Rehabil. 2014 Dec 11;11:161. doi: 10.1186/1743-0003-11-161

BACKGROUND: This study aimed to assess fatigue amongst young adults with spastic cerebral palsy (CP), to determine subgroups at risk for fatigue and to explore the relationship between fatigue and cardiopulmonary fitness and daily physical activity level.

PARTICIPANTS: Young adults with spastic CP, Gross Motor Function Classification System (GMFCS) levels I to III, aged 16 to 24 years.

METHODS: Fatigue (Fatigue Severity Scale) and self-reported daily physical activity (Physical Activity Scale for Individuals with Physical Disabilities) were assessed for 56 participants using questionnaires. Daily physical activity was objectively measured using accelerometry (Vitamove system) over 72 hours. Progressive maximal aerobic cycling was used to measure cardiopulmonary fitness.

RESULTS: The mean Fatigue Severity Scale (FSS) score was 3.7 (SD 1.4). Forty percent of participants were fatigued, including 12.5% who were severely fatigued. Participants with bilateral CP (FSS = 4.2 (SD 1.4)) were more fatigued compared to those with unilateral CP (FSS = 3.1 (SD 1.3)) ($p < 0.01$). Levels of cardiopulmonary fitness (2.4 L/min (SD

0.8)) and daily physical activity (8.5% (SD 3.0)) were not significantly related to fatigue (respectively $p = 0.10$ and $p = 0.55$), although for cardiopulmonary fitness a trend was found.

CONCLUSIONS: Fatigue is already present at a relatively young age amongst adults with CP, and CP subtype is a determinant of fatigue. We did not find significant evidence for a cross-sectional relation of fatigue with cardiopulmonary fitness or daily physical activity.

TRIAL REGISTRATION: Nederland's trial register: NTR1785.

[Free PMC Article](#)

PMCID: PMC4274699

PMID: 25495688 [PubMed - indexed for MEDLINE]

Langage -parole-communication

Does early communication mediate the relationship between motor ability and social function in children with cerebral palsy?

Lipscombe B, Boyd RN, Coleman A, Fahey M, Rawicki B, Whittingham K.

Res Dev Disabil. 2016 Mar 5;53-54:279-286. doi: 10.1016/j.ridd.2016.02.013. [Epub ahead of print]

BACKGROUND: Children diagnosed with neurodevelopmental conditions such as cerebral palsy (CP) are at risk of experiencing restrictions in social activities negatively impacting their subsequent social functioning. Research has identified motor and communication ability as being unique determinants of social function capabilities in children with CP, to date, no research has investigated whether communication is a mediator of the relationship between motor ability and social functioning.

AIMS: To investigate whether early communication ability at 24 months corrected age (ca.) mediates the relationship between early motor ability at 24 months ca. and later social development at 60 months ca. in a cohort of children diagnosed with cerebral palsy (CP).

METHOD: A cohort of 71 children (43 male) diagnosed with CP (GMFCS I=24, 33.8%, II=9, 12.7%, III=12, 16.9%, IV=10, 14.1%, V=16, 22.5%) were assessed at 24 and 60 months ca. Assessments included the Gross Motor Function Measure (GMFM), the Communication and Symbolic Behaviour Scales-Developmental Profile (CSBS-DP) Infant-Toddler Checklist and the Paediatric Evaluation of Disability Inventory (PEDI). A mediation model was examined using bootstrapping.

RESULTS: Early communication skills mediated the relationship between early motor abilities and later social functioning, $b=0.24$ (95% CI=0.08-0.43 and the mediation model was significant, $F(2, 68)=32.77$, $p<0.001$, $R(2)=0.49$).

CONCLUSIONS AND IMPLICATION: Early communication ability partially mediates the relationship between early motor ability and later social function in children with CP. This demonstrates the important role of early communication in ongoing social development. Early identification of communication delay and enriched language exposure is crucial in this population.

Copyright © 2016 Elsevier Ltd. All rights reserved.

PMID: 26955913 [PubMed - as supplied by publisher]

Sommeil

Obstructive sleep apnea in children: update on the recognition, treatment and management of persistent disease.

Tan HL, Kheirandish-Gozal L, Gozal D.

Expert Rev Respir Med. 2016 Mar 21:1-9. [Epub ahead of print]

Adenotonsillectomy (AT) is the recommended first-line treatment for pediatric obstructive sleep apnea (OSA) in children with adenotonsillar hypertrophy. It is now clearly established that AT results in improvement in the severity of OSA in most children. However, a significant number of OSA children undergoing AT exhibit residual persistent OSA post-surgery. Patients at increased risk of persistent OSA include those with severe disease at initial review, older or obese patients, children with underlying asthma or allergic rhinitis, and those who have concurrent underlying medical conditions, such as Trisomy 21, craniofacial syndromes or cerebral palsy. Here, we aim to highlight recent research

findings into those who have persistent OSA disease, and suggest a practical approach to the management of these children.

PMID: 26949836 [PubMed - as supplied by publisher]

Obstructive sleep apnea in children with cerebral palsy and epilepsy.

Garcia J, Wical B, Wical W, Schaffer L, Wical T, Wendorf H, Roiko S.

Dev Med Child Neurol. 2016 Mar 16. doi: 10.1111/dmcn.13091. [Epub ahead of print]

AIM: To examine the risk of obstructive sleep apnea (OSA) in children with cerebral palsy (CP) and/or epilepsy.

METHOD: This cross-sectional study employs the Pediatric Sleep Questionnaire (PSQ), the Gross Motor Function Classification System (GMFCS), and chart review to identify symptoms of OSA in children presenting to a multi-specialty pediatric healthcare institution.

RESULTS: Two-hundred and fifteen patients were grouped into those with epilepsy (n=54), CP (n=18), both (n=55), and neither (comparison group, n=88). The comparison group comprised children with developmental disabilities but not children with typical development. Significantly increased PSQ scores (indicating increased risk of OSA) were found among children with CP (58%) and CP with epilepsy (67%) than among the comparison group (27%; $p<0.001$ and $p<0.0001$ respectively). Children with both CP and epilepsy had a greater number of increased PSQ scores compared with CP alone ($p<0.05$). Increased PSQ scores were observed with increasing CP severity as measured using the GMFCS. The PSQ identified more children at risk of OSA (46%) than did the medical record review for symptoms of OSA (8.2%, $p<0.001$).

INTERPRETATION: Children with CP of greater severity or comorbid epilepsy are at increased risk of OSA. This study supports the routine questionnaire-based assessment for OSA as a regular part of the care of all children with CP, especially in those with more severe CP and those with epilepsy.

© 2016 Mac Keith Press.

PMID: 26991829 [PubMed - as supplied by publisher]

Autres Troubles /troubles concomitants

✚ Troubles respiratoires

Change in Pulmonary Function after Incentive Spirometer Exercise in Children with Spastic Cerebral Palsy: A Randomized Controlled Study.

Choi JY, Rha DW, Park ES.

Yonsei Med J. 2016 May;57(3):769-75. doi: 10.3349/ymj.2016.57.3.769.

PURPOSE: The aim of this study was to investigate the effect of incentive spirometer exercise (ISE) on pulmonary function and maximal phonation time (MPT) in children with spastic cerebral palsy (CP).

MATERIALS AND METHODS: Fifty children with CP were randomly assigned to two groups: the experimental group and the control group. Both groups underwent comprehensive rehabilitation therapy. The experimental group underwent additional ISE. The forced vital capacity (FVC), forced expiratory volume at one second (FEV₁), FEV₁/FVC ratio, peak expiratory flow (PEF), and MPT were assessed as outcome measures before and after 4 weeks of training.

RESULTS: There were significant improvements in FVC, FEV₁, PEF, and MPT in the experimental group, but not in the control group. In addition, the improvements in FVC, FEV₁, and MPT were significantly greater in the experimental group than in the control group.

CONCLUSION: The results of this randomized controlled study support the use of ISE for enhancing pulmonary function and breath control for speech production in children with CP.

[Free Article](#)

PMCID: PMC4800370 [Available on 2016-05-01]

PMID: 26996580 [PubMed - in process]

Community-Acquired Pneumonia Hospitalization among Children with Neurologic Disorders.

Millman AJ, Finelli L, Bramley AM, Peacock G, Williams DJ, Arnold SR, Grijalva CG, Anderson EJ, McCullers JA, Ampofo K, Pavia AT, Edwards KM, Jain S.

J Pediatr. 2016 Mar 17. pii: S0022-3476(16)00271-7. doi:10.1016/j.jpeds.2016.02.049. [Epub ahead of print]

Science Infos Paralysie Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 48 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

OBJECTIVE: To describe and compare the clinical characteristics, outcomes, and etiology of pneumonia among children hospitalized with community-acquired pneumonia (CAP) with neurologic disorders, non-neurologic underlying conditions, and no underlying conditions.

STUDY DESIGN: Children <18 years old hospitalized with clinical and radiographic CAP were enrolled at 3 US children's hospitals. Neurologic disorders included cerebral palsy, developmental delay, Down syndrome, epilepsy, non-Down syndrome chromosomal abnormalities, and spinal cord abnormalities. We compared the epidemiology, etiology, and clinical outcomes of CAP in children with neurologic disorders with those with non-neurologic underlying conditions, and those with no underlying conditions using bivariate, age-stratified, and multivariate logistic regression analyses.

RESULTS: From January 2010-June 2012, 2358 children with radiographically confirmed CAP were enrolled; 280 (11.9%) had a neurologic disorder (52.1% of these individuals also had non-neurologic underlying conditions), 934 (39.6%) had non-neurologic underlying conditions only, and 1144 (48.5%) had no underlying conditions. Children with neurologic disorders were older and more likely to require intensive care unit (ICU) admission than children with non-neurologic underlying conditions and children with no underlying conditions; similar proportions were mechanically ventilated. In age-stratified analysis, children with neurologic disorders were less likely to have a pathogen detected than children with non-neurologic underlying conditions. In multivariate analysis, having a neurologic disorder was associated with ICU admission for children ≥ 2 years of age.

CONCLUSIONS: Children with neurologic disorders hospitalized with CAP were less likely to have a pathogen detected and more likely to be admitted to the ICU than children without neurologic disorders.

Published by Elsevier Inc.

PMID: 27017483 [PubMed - as supplied by publisher]

Gastroenterologie

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

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

Arch Phys Med Rehabil. 2015 Dec;96(12):2176-83. doi: 10.1016/j.apmr.2015.08.411. Epub 2015 Aug 22.

OBJECTIVES: To determine the prevalence and type of bowel symptoms, and their impact on health-related quality of life (HRQOL) in adults with cerebral palsy (CP).

DESIGN: Prospective cross-sectional study.

SETTING: Urban, outpatient rehabilitation facility.

PARTICIPANTS: Adults with CP (N=91; 46 men, 45 women; mean age, 36y; age range, 18-79y).

INTERVENTION: Not applicable.

MAIN OUTCOME MEASURES: Participants were interviewed using standardized instruments to assess the frequency and types of bowel dysfunction. The International Consultation of Incontinence Questionnaire-Bowel was used to assess bowel incontinence and impact on quality of life, and constipation presence was determined using the Rome III criteria for constipation. Constipation symptoms were rated by the Patient Assessment of Constipation-Symptom Scale. Participants' mobility status was classified using the Gross Motor Function Classification System (GMFCS). Interactions between mobility measures, anthropometric measures, and bowel symptoms were assessed.

RESULTS: Of the 91 participants enrolled, 62.6% were GMFCS IV or V. Twenty-eight participants (30.8%) reported severe difficulty with control of liquid stool (rating never or rarely); these participants were more likely to have a greater GMFCS level (P=.0004). Twenty-six participants (28.6%) reported that bowel function caused embarrassment some/most/all of the time. Fifty-nine participants (64.8%) met criteria for chronic constipation, which did not differ by GMFCS levels. Overall, 57.1% of participants reported that bowel symptoms interfered with life; 40.7% reported moderate to severe interference.

CONCLUSIONS: Bowel symptoms were frequent, a source of embarrassment, and impacted HRQOL in these adults with CP. Addressing bowel-related symptoms has the potential to improve HRQOL in these adults.

Copyright © 2015 American Congress of Rehabilitation Medicine. Published by Elsevier Inc. All rights reserved.

PMID: 26301386 [PubMed - indexed for MEDLINE]

Impact of oral diseases and disorders on oral-health-related quality of life of children with cerebral palsy.

Abanto J, Ortega AO, Raggio DP, Bönecker M, Mendes FM, Ciamponi AL.

Spec Care Dentist. 2014 Mar-Apr;34(2):56-63. doi: 10.1111/scd.12028. Epub 2013 Jun 4.

The aim of this study was to investigate the impact of oral diseases and disorders on the oral-health-related quality of life (OHRQoL) of children with CP, adjusting this impact by socioeconomic factors. Data were collected from 60 pairs of parents-children with CP. Parents answered the child oral health quality of life questionnaire (parental-caregivers perception questionnaire and family impact scale) and a socioeconomic questionnaire. Dental caries experience, traumatic dental injuries, malocclusions, bruxism, and dental fluorosis were also evaluated. The multivariate adjusted model showed that dental caries experience ($p < 0.001$) and the presence of bruxism had a negative impact ($p = 0.046$) on the OHRQoL. A greater family income had a positive impact on it ($p < 0.001$). Dental caries experience and bruxism are conditions strongly associated with a negative impact on OHRQoL of children with CP and their parents, but a higher family income can improve this negative impact.

© 2013 Special Care Dentistry Association and Wiley Periodicals, Inc.

PMID: 24588489 [PubMed - indexed for MEDLINE]

The effect of oral sensorimotor stimulations on feeding performance in children with spastic cerebral palsy.

Kaviyani Baghbadorani M(1), Soleymani Z(2), Dadgar H(3), Salehi M(4).

Acta Med Iran. 2014;52(12):899-904.

Oral feeding difficulties are common in children with cerebral palsy (CP). The effect of oral-motor dysfunction on feeding problems has been proved in several studies. The purpose of the present study was to evaluate the effect of oral sensorimotor stimulations on feeding performance in children with spastic cerebral palsy. A total of 12 children with spastic cerebral palsy underwent 24 sessions of oral-motor stimulations (3 days per week). The effect of the intervention was assessed after the 12 and 24 sessions. Feeding skills were assessed using Oral Motor Assessment Scale (OMAS). Data were analyzed using Friedman test and intra class correlation coefficient (ICC). The results of the study revealed a significant improvement in feeding skills including mouth closure, lip closure on the utensil, lip closure during deglutition, control of the food during swallowing, mastication, straw suction and control of liquid during deglutition. There were more improvement in mouth closure and less in straw suction. This study showed sensorimotor stimulation is useful for the treatment of the feeding problems, but the progress was not perfect. This could be due to the role of the position and cognitive skills in feeding functions. Thus, other strategies should be considered to achieve more improvement in feeding performance.

[Free Article](#)

PMID: 25530052 [PubMed - indexed for MEDLINE]

Comparative Study of Refractive Errors, Strabismus, Microsaccades, and Visual Perception Between Preterm and Full-Term Children With Infantile Cerebral Palsy.

Kozeis N, Panos GD, Zafeiriou DI, de Gottrau P, Gatziofufas Z

J Child Neurol. 2015 Jul;30(8):972-5. doi: 10.1177/0883073814549248. Epub 2014 Oct 7.

The purpose of this study was to examine the refractive status, orthoptic status and visual perception in a group of preterm and another of full-term children with cerebral palsy, in order to investigate whether prematurity has an effect on the development of refractive errors and binocular disorders. A hundred school-aged children, 70 preterm and 30 full-term, with congenital cerebral palsy were examined. Differences for hypermetropia, myopia, and emmetropia were not statistically significant between the 2 groups. Astigmatism was significantly increased in the preterm group. The orthoptic status was similar for both groups. Visual perception was markedly reduced in both groups, but the differences were not significant. In conclusion, children with cerebral palsy have impaired visual skills, leading to reading difficulties. The presence of prematurity does not appear to represent an additional risk factor for the development of refractive errors and binocular disorders.

© The Author(s) 2014.

✚ Neuropsychologie – Comportement

Recent Advances in the Neuroimaging and Neuropsychology of Cerebral Palsy.

Gosling AS.

Appl Neuropsychol Child. 2016 Mar 17:1-8. [Epub ahead of print]

This article reviews the recent advances in understanding of cerebral palsy (CP) and outlines how these advances could inform pediatric neuropsychological rehabilitation. Three main areas are discussed: the improved delineation of differing presentations resulting from more advanced imaging techniques with emerging links to function; a brief review of research examining neuropsychological functioning of children with CP and their quality of life and participation; and lastly, some of the evidence for efficacious interventions and the extent to which these interventions are derived from neuropsychological theory and practice. Advances and gaps in knowledge in addition to suggestions of areas for future focus in research and practice are discussed throughout the article.

PMID: 26985833 [PubMed - as supplied by publisher]

✚ Troubles de la croissance

Growth during infancy and early childhood in children with cerebral palsy: a population-based study.

Strand KM, Dahlseng MO, Lydersen S, Rø TB, Finbråten AK, Jahnsen RB, Andersen GL, Vik T.

Dev Med Child Neurol. 2016 Mar 15. doi: 10.1111/dmcn.13098. [Epub ahead of print]

AIM: To describe growth in infancy and early childhood in children with cerebral palsy (CP).

METHOD: One hundred and four children with CP born at minimum 36 weeks' gestation in 2002 to 2010 were included. Prospectively collected growth data were requested from public health clinics. We calculated standard deviation (SD) scores (z-scores) for weight and height for 12 set age points for each child from birth to 5 years, and for head circumference from birth to 12 months.

RESULTS: Children with CP had normal growth in weight and height if they were born non-small for gestational age (non-SGA) or had mild motor impairments (i.e. Gross Motor Function Classification System [GMFCS] I-II), whereas children born SGA or with severe motor impairments (GMFCS III-V) had reduced growth ($p < 0.001$). Children with feeding difficulties in infancy had reduced growth in weight and height throughout early childhood, while children without feeding difficulties had normal growth. Head circumference growth decreased most severely among children born SGA, who had mean z-scores of -3.0 (95% confidence interval [CI] -3.7 to -2.2) at 1 year.

INTERPRETATION: Children with mild CP had normal growth in weight and height until 5 years, and in head circumference during infancy. Feeding difficulties in infancy and being born SGA were strongly associated with reduced growth.

© 2016 Mac Keith Press.

PMID: 26992128 [PubMed - as supplied by publisher]

Qualité de vie et rapport au monde

✚ Activité physique - Sport

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.

Science Infos Paralysie Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 51 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

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.

© 2016 The Author(s).

PMID: 26920432 [PubMed - as supplied by publisher]

Accompagnement

An evaluation of psychometric properties of caregiver burden outcome measures used in caregivers of children with cerebral palsy: a systematic review protocol.

Dambi JM, Jelsma J, Mlambo T, Chiwaridzo M, Dangarembizi-Munambah N, Corten L.

Syst Rev. 2016 Mar 9;5(1):42. doi: 10.1186/s13643-016-0219-3.

BACKGROUND: Cerebral palsy (CP) is the most common, life-long paediatric disability. Taking care of a child with CP often results in caregiver burden/strain in the long run. As caregivers play an essential role in the rehabilitation of these children, it is therefore important to routinely screen for health outcomes in informal caregivers. Consequently, a plethora of caregiver burden outcome measures have been developed; however, there is a dearth of evidence of the most psychometrically sound tools. Therefore, the broad objective of this systematic review is to evaluate the psychometrical properties and clinical utility of tools used to measure caregiver burden in caregivers of children with CP.

METHODS/DESIGN: This is a systematic review for the evaluation of the psychometric properties of caregiver burden outcome tools. Two independent and blinded reviewers will search articles on PubMed, Scopus, Web of Science, CINAHL, PsychINFO and Africa-Wide Google Scholar. Information will be analysed using predefined criteria. Thereafter, three independent reviewers will then screen the retrieved articles. The methodological quality of studies on the development and validation of the identified tools will be evaluated using the four point COnsensus-based Standards for the selection of health Measurement Instruments (COSMIN) checklist. Finally, the psychometric properties of the tools which were developed and validated from methodological sound studies will then be analysed using predefined criteria.

DISCUSSION: The proposed systematic review will give an extensive review of the psychometrical properties of tools used to measure caregiver burden in caregivers of children with CP. We hope to identify tools that can be used to accurately screen for caregiver burden both in clinical setting and for research purposes.

SYSTEMATIC REVIEW REGISTRATION: PROSPERO CRD42015028026 .

[Free PMC Article](#)

PMCID: PMC4785644

Science Infos Paralysie Cérébrale , mars 2016, FONDATION MOTRICE 67 rue Vergniaud 75013 Paris - tel +33 52 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

PMID: 26960677 [PubMed - in process]

Factors associated with caregiver experience in families with a child with cerebral palsy.

Lowes L, Clark TS, Noritz G.

J Pediatr Rehabil Med. 2016 Feb 27;9(1):65-72. doi: 10.3233/PRM-160362.

PURPOSE: Managing the stresses of parenting a child with cerebral palsy (CP) can be challenging. This study sought to identify factors that are associated with higher levels of caregiver stress.

METHODS: A retrospective review of data from the Learn From Every Patient™ project conducted in an interdisciplinary CP clinic were used to compare caregiver responses on 2 subsets (financial and time/emotional) of the Assessment of Caregiver Experience in Neuromuscular Disorders (ACEND) and physical and medical characteristics of the child.

RESULTS: The range of scores in both the financial and emotional subset was large. The presence of behavior problems, seizures, and severity of CP showed the strongest associations with emotional stress and accounted for 14% of the variance in scaled scores ($r = 0.392$, $\text{adj } R^2 = 14.3$, $p < 0.01$). The child's age was not significantly related to parental stress. The most highly reported areas of stress were worry about the child's pain, and the financial impact of lost wages.

CONCLUSION: Caregiver experience varied widely and is associated with a range of factors among families caring for a child with CP. Further research is needed to test whether interventions to minimize the areas of greatest stress could make a meaningful difference in family functioning.

PMID: 26966802 [PubMed - in process]

Fatigue in the mothers of children with cerebral palsy.

Garip Y, Ozel S, Tuncer OB, Kilinc G, Seckin F, Arasil T.

Disabil Rehabil. 2016 Mar 25:1-6. [Epub ahead of print]

PURPOSE: To evaluate fatigue in the mothers of children with cerebral palsy (CP), and to determine its associations with clinical parameters of CP, depression and quality of life (QoL).

METHOD: Ninety children (50 girls and 40 boys) with spastic CP and their mothers were included. Control group comprised mothers of healthy children. Gross motor function classification system (GMFCS) was used for determining functional status. Spasticity was evaluated by using modified Ashworth scale. Fatigue symptom inventory (FSI) was used for assessing maternal fatigue, Nottingham health profile (NHP) for maternal QoL, and Beck Depression Scale (BDS) for maternal depression.

RESULTS: Mothers of children with CP scored significantly higher in all FSI subgroups (intensity of fatigue, duration of fatigue and interference with QoL), all NHP subgroups and BDS ($p < 0.05$) when compared with controls. FSI was found to be correlated with BDS and all subgroups of NHP ($p < 0.01$). No association was found between FSI and clinical parameters of children with CP including age, gender, type of CP, tone and functional impairment ($p > 0.05$).

CONCLUSIONS: Our findings indicate that fatigue levels of mothers with CP children are higher than those with healthy children and associated with depression and deterioration in QoL in terms of physical, social and emotional functioning. This should be considered while designing a family centred rehabilitation programme for children with CP. Implications for Rehabilitation Caring for a child with cerebral palsy has psychological, social and financial impacts on families and is associated with increased levels of fatigue among mothers. The capacity of current programs and services needs to be strengthened to accommodate the needs of children with CP and their mothers in order to reduce fatigue of mothers. New programs need to be developed to provide psychosocial support for the mothers and to reduce their fatigue as they continue to care for their children. Provision of assistive technology devices (particularly suitable wheelchairs) will be useful in reduction of fatigue levels of mothers.

PMID: 27015263 [PubMed - as supplied by publisher]

Higher Levels of Caregiver Strain Perceived by Indian Mothers of Children and Young Adults with Cerebral Palsy Who have Limited Self-Mobility.

Prakash V, Patel AM, Hariom K, Palisano RJ.

Phys Occup Ther Pediatr. 2016 Mar 16:1-10. [Epub ahead of print]

AIM: Describe and compare the caregiver strain experienced among Indian mothers of children and young adults with cerebral palsy (CP) living in low resource settings.

Science Infos Paralysie Cérébrale , mars 2016, **FONDATION MOTRICE** 67 rue Vergniaud 75013 Paris - tel +33 53 1 45 54 03 03 contact: Christine Doumergue cdoumergue@lafondationmotrice.org

METHODS: 62 consecutive children and young adults with spastic CP (mean age 6.0 ± 4.5 , range 2-21) and their parents were recruited from an outpatient physiotherapy department for this cross-sectional study. Ability to walk was classified using the Gross Motor Function Classification System and mother's caregiver strain was measured using caregiver strain index (CSI).

RESULTS: Mothers of children and young adults who have limited self-mobility perceived higher caregiver strain (mean CSI score 12.0 ± 1.3 , $p < 0.05$) than mothers of children who can walk (mean CSI score 4.5 ± 3.0 , $p < 0.05$). All 46 mothers of children and youth in GMFCS levels IV and V reported high levels of caregiver stress compared with only three of 16 mothers of children and youth who walk (levels I and II).

CONCLUSIONS: Physiotherapists and occupational therapists serving children and youth with CP are encouraged to partner with families to identify goals for ease of caregiving, activity, and participation at home and in the community.
PMID: 26984713 [PubMed - as supplied by publisher]

Impact of child and family characteristics on cerebral palsy treatment.

Rackauskaite G, Uldall PW, Bech BH, Østergaard JR.

Dev Med Child Neurol. 2015 Oct;57(10):948-54. doi: 10.1111/dmcn.12791. Epub 2015 May 8.

Comment in *Dev Med Child Neurol.* 2015 Oct;57(10):894-5.

AIM: The aim of the study was to describe the relationship between the child's and family's characteristics and the most common treatment modalities in a national population-based sample of 8- to 15-year-old children with cerebral palsy.

METHOD: A cross-sectional study, based on the Danish Cerebral Palsy Registry. The parents of 462 children answered a questionnaire about their child's treatment and the family's characteristics (living with a single parent, having siblings, living in a city, parental education level). Descriptive and logistic regression analyses were performed for every treatment modality, stratified by Gross Motor Function Classification System (GMFCS) level.

RESULTS: An IQ below 85 was associated with weekly therapy in GMFCS level I (adjusted odds ratio [ORadj] 2.5 [CI 1.1-5.7]) and the use of oral spasmolytics in GMFCS levels III to V (ORadj 3.1 [CI 1.3-7.4]). Older children in GMFCS levels III to V used daily orthoses less frequently (ORadj 0.7 [CI 0.6-0.9] per year). Of all of the family characteristics studied, only the parents' education level had significant associations with more than one treatment modality.

INTERPRETATION: A child's cognitive function showed an impact on treatment of the motor impairment in children 8 to 15 years of age with cerebral palsy. Parental education level may influence the choice of treatment.

© 2015 Mac Keith Press.

PMID: 25952577 [PubMed - indexed for MEDLINE]

Informal caregivers of clients with neurological conditions: profiles, patterns and risk factors for distress from a home care prevalence study.

Mitchell LA, Hirdes J, Poss JW, Slegers-Boyd C, Caldarelli H, Martin L.

BMC Health Serv Res. 2015 Aug 28;15:350. doi: 10.1186/s12913-015-1010-1.

BACKGROUND: Individuals living in the community with neurological conditions receive the majority of their care from informal caregivers. The purpose of this project was to provide a profile of caregivers of home care clients with neurological conditions. The study also examined prevalence of caregiver distress and the association between neurological conditions and other client and caregiver characteristics with distress.

METHODS: The study population included Canadian home care clients in the Winnipeg Regional Health Authority in Manitoba and in the province of Ontario. Clients with RAI-Home Care (RAI-HC) assessment data from 2003 to 2010 were examined. Neurological conditions of interest included Alzheimer's disease and related dementias, multiple sclerosis, amyotrophic lateral sclerosis, Parkinson's disease, Huntington disease, epilepsy, muscular dystrophy, cerebral palsy, traumatic brain injury, spinal cord injury, and stroke. Descriptive statistics were analyzed to describe home care client characteristics and caregiver characteristics for each neurological condition. Logistic regression analysis was used to identify risk factors associated with caregiver distress.

RESULTS: A substantial proportion of home care clients were found to have one or more of the neurological conditions (38.8% to 41.9%). Caregiver distress was twice as prevalent among caregivers of clients with neurological conditions (28.0%). The largest associations with caregiver distress were the amount of informal care hours provided in a week and the MAPLe algorithm, an indicator of a client's level of priority for care. After adjustment for client characteristics, Huntington disease was the neurological condition most strongly associated with caregiver distress. However, clients'

clinical characteristics and informal care hours had a stronger association with caregiver distress than the presence of a neurological condition. Provision of formal home care services provided a protective effect from caregiver distress. CONCLUSIONS: Neurological conditions are common among home care clients and a significant proportion of informal caregivers providing care to these clients experience distress. The complexity of clients with neurological conditions suggests the need for multicomponent support strategies for informal caregivers.

PMCID: PMC4552273

PMID: 26315104 [PubMed - indexed for MEDLINE]

Parents' experiences and needs regarding physical and occupational therapy for their young children with cerebral palsy.

Kruijzen-Terpstra AJ, Verschuren O, Ketelaar M, Riedijk L, Gorter JW, Jongmans MJ, Boeije H; LEARN 2 MOVE 2-3 Study Group.

Res Dev Disabil. 2016 Mar 10;53-54:314-322. doi: 10.1016/j.ridd.2016.02.012. [Epub ahead of print]

OBJECTIVE: To explore the experiences and needs of parents of young children (aged 2-4 years) with cerebral palsy (CP) regarding their child's physical and occupational therapy process in a rehabilitation setting.

METHODS: A qualitative design was used involving semi-structured interviews with 21 parents of young children with CP. Interviews were conducted until informational redundancy was achieved.

RESULTS: Three major themes were identified: Information, communication and partnership. A fourth, overarching theme emerged: The process of parent empowerment. Experiences and needs differed between parents and changed over time.

CONCLUSION: This study suggests that various themes play a key role in the experiences and needs of parents of young children with CP. The identified themes provide important insights into how and why service providers might change their approach.

PRACTICE IMPLICATIONS: Becoming empowered is a dynamic process for parents, in which both parents and service providers play a role. Service providers should continually adapt their role to parents' needs of information, communication and partnership, and they should support and facilitate parents in becoming empowered. For that, service providers should be educated on the process of parent empowerment, on ways to facilitate this process and on the importance of involving and interacting with parents. This allows families of young children with CP to be provided with services that best suit their needs.

Copyright © 2016 Elsevier Ltd. All rights reserved.

PMID: 26970858 [PubMed - as supplied by publisher]

Predictors of caregiver depression and family functioning after perinatal stroke.

Bemister TB, Brooks BL, Dyck RH, Kirton A.

BMC Pediatr. 2015 Jul 15;15:75. doi: 10.1186/s12887-015-0397-5.

BACKGROUND: Perinatal stroke is a leading cause of cerebral palsy and lifelong neurological morbidity. Studies on perinatal stroke outcomes are increasing, although examinations of its broader impact on parents and families have been limited. A recent study found that parents of children with moderate and severe outcomes have increased risk for psychosocial concerns, including depressive symptoms and poor family functioning. Other parents adapt remarkably well, but how this occurs is unknown. The primary aim of this study was to examine predictors of parent and family outcomes, namely caregiver depression and family functioning. The secondary aim was to explore potential mediators and moderators of the relationship between condition severity and parent and family outcomes.

METHODS: Parents were recruited from a large, population-based perinatal stroke research cohort, and they completed measures assessing their demographics, social supports, stress levels, marital quality, feelings of guilt and blame, psychological well-being, and family functioning. Bivariate analyses compared these variables. Predictor variables, mediators, and moderators were chosen according to the strength of their relationship with the outcome variables (i.e., caregiver depression and family functioning) and theory. Hierarchical regression, mediator, and moderator analyses were conducted accordingly.

RESULTS: A total of 103 parents participated in this study (76 mothers, 27 fathers; mean age of 39.2 years; mean child age of 7.46 years). Condition severity, anxiety, social support, and blame independently predicted caregiver depression while condition severity, stress levels, and marital quality independently predicted family functioning. Blame regarding the cause of their child's condition also mediated the relationship between condition severity and

caregiver depression.

CONCLUSIONS: Adverse parental outcomes can be predicted in perinatal stroke populations. Moreover, anxiety and stress management techniques, marital support, and psychoeducation regarding the unpreventable nature of perinatal stroke may be utilized in the future to enhance family outcomes.

[Free PMC Article](#)

PMCID: PMC4502550

PMID: 26174779 [PubMed - indexed for MEDLINE]

Quantifying multifaceted needs captured at the point of care. Development of a Disabilities Terminology Set and Disabilities Complexity Scale.

Horridge KA, Harvey C, McGarry K, Williams J, Whitlingum G, Busk M, Fox S, Baird G, Spencer A.
Dev Med Child Neurol. 2016 Mar 23. doi: 10.1111/dmcn.13102. [Epub ahead of print]

AIMS: To develop a Disabilities Terminology Set and quantify the multifaceted needs of disabled children and their families in a district disability clinic population.

METHOD: Data from structured electronic clinic letters of children attending paediatric disability clinics from June 2007 to May 2012 in Sunderland, north-east England collected at the point of clinical care were analysed to determine appropriate terms for consistent recording of each need and issue. Terms were collated to count the number of needs per child.

RESULTS: A Systemized Nomenclature of Medicine - Clinical Terms subset of 296 terms was identified and published, and 8392 consultations for 1999 children were reviewed. The required number of clinic appointments correlated strongly with the number of needs identified. Children with intellectual disabilities in addition to cerebral palsy and epilepsy had more than double the number of conditions, technology dependencies, and family-reported issues than those without. Disabled children who subsequently died had the highest burden of needs ($p=0.007$).

INTERPRETATION: Detailed data about needs generated outputs useful for local care pathway development and service planning. Sufficient evidence was provided for successful business cases leading to the appointment of additional paediatric disability consultants. Counting numbers of needs and issues quantifies complexity in a straightforward way. This could underpin needs-based commissioning of services.

© 2016 Mac Keith Press.

PMID: 27009933 [PubMed - as supplied by publisher]

Domotique - Nouvelles technologies – Matériel médical

Adaptive seating systems in children with severe cerebral palsy across International Classification of Functioning, Disability and Health for Children and Youth version domains: a systematic review.

Angsupaisal M, Maathuis CG, Hadders-Algra M.

Dev Med Child Neurol. 2015 Oct;57(10):919-30. doi: 10.1111/dmcn.12762. Epub 2015 Apr 9.

AIM: The aim of this study was to systematically review the effect of adaptive seating systems (AdSSs) in young people less than 19 years of age with severe cerebral palsy (CP), with particular focus on child-related outcomes across all components of the functioning and disability domains of the International Classification of Functioning, Disability, and Health for Children and Youth version (ICF-CY).

METHOD: Literature searches of studies published from 1975 to October 2014 were performed. Methodological quality and the risk of bias were analysed using Sackett's level of evidence, the American Academy for Cerebral Palsy and Developmental Medicine guidelines, and Mallen criteria for observational studies.

RESULTS: Nine studies fulfilled the selection criteria. All studies had level IV evidence and were of moderate methodological quality. The results focused on the effects of AdSSs on postural control and on upper extremity function and on additional child-related outcomes. The results suggested that AdSSs that include trunk and hip support devices may improve postural control outcomes, and that special-purpose AdSSs may improve self-care and play behaviour at home.

INTERPRETATION: Because of a low level of evidence and the moderate methodological quality of the studies available, no robust conclusions can be drawn. Nevertheless, the data suggest that AdSSs may be able to improve activity and

participation at home among children with severe CP. More studies of high methodological quality addressing the effect of AdSSs on activity and participation are urgently needed. Suggestions for future research are provided.

© 2015 Mac Keith Press.

PMID: 25857828 [PubMed - indexed for MEDLINE]

Performing mathematics activities with non-standard units of measurement using robots controlled via speech-generating devices: three case studies.

Adams KD, Cook AM.

Disabil Rehabil Assist Technol. 2016 Mar 15:1-13. [Epub ahead of print]

Purpose To examine how using a Lego robot controlled via a speech-generating device (SGD) can contribute to how students with physical and communication impairments perform hands-on and communicative mathematics measurement activities. This study was a follow-up to a previous study. **Method** Three students with cerebral palsy used the robot to measure objects using non-standard units, such as straws, and then compared and ordered the objects using the resulting measurement. Their performance was assessed, and the manipulation and communication events were observed. Teachers and education assistants were interviewed regarding robot use. **Results** Similar benefits to the previous study were found in this study. Gaps in student procedural knowledge were identified such as knowing to place measurement units tip-to-tip, and students' reporting revealed gaps in conceptual understanding. However, performance improved with repeated practice. Stakeholders identified that some robot tasks took too long or were too difficult to perform. **Conclusions** Having access to both their SGD and a robot gave the students multiple ways to show their understanding of the measurement concepts. Though they could participate actively in the new mathematics activities, robot use is most appropriate in short tasks requiring reasonable operational skill. **Implications for Rehabilitation** Lego robots controlled via speech-generating devices (SGDs) can help students to engage in the mathematics pedagogy of performing hands-on activities while communicating about concepts. Students can "show what they know" using the Lego robots, and report and reflect on concepts using the SGD. Level 1 and Level 2 mathematics measurement activities have been adapted to be accomplished by the Lego robot. Other activities can likely be accomplished with similar robot adaptations (e.g., gripper, pen). It is not recommended to use the robot to measure items that are long, or perform measurements that require high operational competence in order to be successful.

PMID: 26978274 [PubMed - as supplied by publisher]

Impacts socio-économiques

Development and implementation of microsimulation models of neurological conditions.

Finès P, Garner R, Bancej C, Bernier J, Manuel DG.

Health Rep. 2016 Mar 16;27(3):3-9.

BACKGROUND: As part of a program of the first National Population Health Study of Neurological Conditions launched in 2009, a series of microsimulation models of neurological conditions (called POHEM-Neurological meta-model) was developed to project health and economic impacts of seven neurological conditions (NCs)-Alzheimer's disease and other dementias, cerebral palsy, epilepsy, multiple sclerosis, Parkinson's disease, traumatic brain injury, and traumatic spinal cord injury-over a 20-year horizon.

DATA AND METHODS: The common framework of the seven models allows for dynamic, continuous-time, discrete-event simulation of synthetic large populations in which persons are subject to the risk of developing the NC under study and are assigned a value of functional health and a probability of receiving a caregiver and of entering long-term care. Calculations for transitions are done every year over the life course, and costs are accumulated throughout the life of the synthetic person. The need to reconcile empirical estimates of incidence and mortality with prevalence required implementation of "cure" parameters for two of the NCs.

RESULTS: The POHEM-Neurological meta-model integrates the latest Canadian microdata on neurological conditions and satisfies most criteria for validation of microsimulation models, including conceptualization, computer implementation, assessment of output plausibility, and comparison with external data. Limitations include an absence of risk factors and the lack of uncertainty measures.

INTERPRETATION: The POHEM-Neurological meta-model has been useful for projections of health and economic impacts of NCs on persons affected and their caregivers, and allows for comparison of specific scenarios to the base case.

[Free Article](#)

PMID: 26983006 [PubMed - in process]

Sociometric status and the attribution of intentions in a sample of adolescents with cerebral palsy.

Voyer AP, Tessier R, Nadeau L.

Disabil Rehabil. 2016 Mar 12:1-6. [Epub ahead of print]

Purpose To examine how cerebral palsy (CP) and sociometric status at age 10 explain the development of a cognitive bias across two groups of adolescents aged 15. **Method** Children with CP (N = 60) and without CP (N = 57) are part of a follow-up study. Three categories of sociometric status (popular, average, rejected) were obtained by conducting a class-wide interview in the class of the target children at age 10. At 15 years old, the same children (CP and non-CP) were asked to complete the Home Interview With Child questionnaire measuring a cognitive bias (hostile attribution of intentions (AI)). **Results** Children with CP, especially girls, were significantly more rejected and less popular than controls at age 10. At age 15, among all participants, sociometric rejected and popular children tended to have a higher percentage of hostile AI than sociometric average children. **Conclusions** There were no significant results for the combined effect of CP and sociometric status on the development of hostile AI at age 15. However, knowing the risk incurred by children with CP of being socially rejected, attention should be paid in the rehabilitation process to opportunities for social participation to facilitate the development of social competence. **Implications for Rehabilitation** Level I or II cerebral palsy (CP) is a condition that affects not only motor abilities but also social competence in children. Sociometric status in a group tends to affect the development of the ability to interpret intentions of others during adolescence. Sociometric measures in the class of children with CP could be a useful tool in the rehabilitation process in order to better define social participation opportunities. To improve social participation attempts, rehabilitation interventions should target social initiating skills, flexibility in interpreting peers' behaviours, and ability to react effectively to negative peer treatment

The heterogeneity in financial and time burden of caregiving to children with chronic conditions.

Zan H, Scharff RL.

Matern Child Health J. 2015 Mar;19(3):615-25. doi: 10.1007/s10995-014-1547-3.

We examine the financial and time burdens associated with caring for children with chronic conditions, focusing on disparities across types of conditions. Using linked data from the 2003 to 2006 National Health Interview Survey and 2004-2008 Medical Expenditure Panel Survey, we created measures of financial burden (out-of-pocket healthcare costs, the ratio of out-of-pocket healthcare costs to family income, healthcare costs paid by insurance, and total healthcare costs) and time burden (missed school time due to illness or injury and the number of doctor visits) associated with 14 groups of children's chronic conditions. We used the two-part model to assess the effect of condition on financial burden and finite mixture/latent class model to analyze the time burden of caregiving. Controlling for the influences of other socio-demographic characteristics on caregiving burden, children with chronic conditions have higher financial and time burdens relative to caregiving burdens for healthy children. Levels of financial burden and burden sharing between families and insurance system also vary by type of condition. For example, children with pervasive developmental disorder or heart disease have a relatively low financial burden for families, while imposing a high cost on the insurance system. In contrast, vision difficulties are associated with a high financial burden for families relative to the costs borne by others. With respect to time burden, conditions such as cerebral palsy and heart disease impose a low time burden, while conditions such as pervasive developmental disorder are associated with a high time burden. This study demonstrates that differences exist in caregiving burden for children by type of chronic condition. Each condition has a unique profile of time and financial cost burden for families and the insurance system. These results have implications for policymakers and for families' savings and employment decisions.

PMID: 24951130 [PubMed - indexed for MEDLINE]



LA FONDATION MOTRICE , Fondation de recherche sur la Paralyse cérébrale
67 rue Vergniaud 75013 Paris
Tel.: + 33 1 45 54 063 03
secretariat@lafondationmotrice.org
www.lafondationmotrice.org