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Professor Nadia Badawi AM

Macquarie Group Foundation Chair of Cerebral Palsy

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Interventions and Management

1. *Res Dev Disabil.* 2014 Aug 8;35(11):2950-2957. doi: 10.1016/j.ridd.2014.07.021. [Epub ahead of print]

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

Klotz MC1, van Drongelen S2, Rettig O3, Wenger P4, Gantz S5, Dreher T6, Wolf SI7.

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.

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2. *Clin Rehabil.* 2014 Aug 14. pii: 0269215514544982. [Epub ahead of print]

Effectiveness of constraint-induced movement therapy on upper-extremity function in children with cerebral palsy: a systematic review and meta-analysis of randomized controlled trials.

Chen YP1, Pope S2, Tyler D2, Warren GL2.

OBJECTIVE: To systematically examine the research literature on the effectiveness of constraint-induced movement therapy on improving arm function in children with cerebral palsy, and to assess the association

between the study effect size and the characteristics of the patients and intervention protocol. DATA SOURCES: A systematic literature search was conducted in PubMed, PsycINFO, Cochrane, CINAHL, Web of Science, and TRIP Database up to May 2014. REVIEW METHODS: Studies employing randomized controlled trial design, children with cerebral palsy, comparing constraint-induced movement therapy with another intervention with a focus on arm function, and upper-extremity measures were included in this review. Methodological quality was evaluated using the Physiotherapy Evidence-based Database (PEDro) scale. RESULTS: The literature search resulted in 27 randomized controlled trial studies with good methodological quality that compared constraint-induced movement therapy with other intervention therapy. Overall, constraint-induced movement therapy provided a medium beneficial effect ($d = 0.546$; $p < 0.001$) when compared with conventional therapy. For the subgroup analyses, presence of a dose-equivalent comparison group, intervention location, and time of follow-up were significant factors. Studies examining constraint-induced movement therapy effect without a dose-equivalent comparison group showed a large effect in children with cerebral palsy, but studies with a dose-equivalent group only showed a small effect. Children who received home-based constraint-induced movement therapy had a better improvement in arm function than those who received constraint-induced movement therapy elsewhere. CONCLUSION: The research literature supports constraint-induced movement therapy as an effective intervention to improve arm function in children with cerebral palsy.

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3. J Electromyogr Kinesiol. 2014 Jul 21. pii: S1050-6411(14)00145-X. doi: 10.1016/j.jelekin.2014.07.004. [Epub ahead of print]

Altered corticomuscular coherence elicited by paced isotonic contractions in individuals with cerebral palsy: A case-control study.

Riquelme I1, Cifre I2, Muñoz MA3, Montoya P4.

The purpose of the study was to analyze corticomuscular coherence during planning and execution of simple hand movements in individuals with cerebral palsy (CP) and healthy controls (HC). Fourteen individuals with CP and 15 HC performed voluntary paced movements (opening and closing the fist) in response to a warning signal. Simultaneous scalp EEG and surface EMG of extensor carpi radialis brevis were recorded during 15 isotonic contractions. Time-frequency corticomuscular coherence (EMG-C3/C4) before and during muscular contraction, as well as EMG intensity, onset latency and duration were analyzed. Although EMG intensity was similar in both groups, individuals with CP exhibited longer onset latency and increased duration of the muscular contraction than HC. CP also showed higher corticomuscular coherence in beta EEG band during both planning and execution of muscular contraction, as well as lower corticomuscular coherence in gamma EEG band at the beginning of the contraction as compared with HC. In conclusion, our results suggest that individuals with CP are characterized by an altered functional coupling between primary motor cortex and effector muscles during planning and execution of isotonic contractions. In addition, the usefulness of corticomuscular coherence as a research tool for exploring deficits in motor central processing in persons with early brain damage is discussed.

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4. Ann Phys Rehabil Med. 2014 Jun 25. pii: S1877-0657(14)01746-1. doi: 10.1016/j.rehab.2014.06.004. [Epub ahead of print]

Motor function levels and pelvic parameters in walking or ambulating children with cerebral palsy.

Bernard JC1, Deceuninck J2, Leroy-Coudeville S3, Loustalet E3, Morel E3, Combey A3, Sutton J3, Berthonnaud E4, Chaléat-Valayer E3.

BACKGROUND: In children with cerebral palsy, spinal equilibrium and pelvic strategies may vary according to the functional status. OBJECTIVES: To study the relationship between motor function and pelvic and spinal parameters in a population of children and adolescents with cerebral palsy (rated from level I to level IV on Gross Motor

Function Classification System [GMFCS]). A sagittal X-ray of the spine in the standing position was analyzed with Optispine® software. RESULTS: The study population comprised 114 children and adolescents (mean [range] age: 12.35 [4-17]). For the study population as a whole, there were significant overall correlations between the GMFCS level on one hand and pelvic incidence and pelvic tilt (PT) on the other ($P=0.013$ and 0.021 , respectively). DISCUSSION: Pelvic parameters vary according to the GMFCS level but do not appear to affect spinal curvature. The sacrum is positioned in front of the head of the femur (i.e. negative PT) in GMFCS level I and progressively moves backwards (i.e. positive PT) in GMFCS levels II, III and IV.

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5. Gait Posture. 2014 Jul 24. pii: S0966-6362(14)00650-X. doi: 10.1016/j.gaitpost.2014.07.014. [Epub ahead of print]

Mechanical work and energy consumption in children with cerebral palsy after single-event multilevel surgery.

Marconi V1, Hachez H2, Renders A3, Docquier PL4, Detrembleur C5.

Multilevel surgery is commonly performed to improve walking in children with cerebral palsy (CP). Classical gait analysis (kinetics, kinematics) demonstrated positive outcomes after this intervention, however it doesn't give global indication about gait's features. The assessment of energy cost and mechanical work of locomotion can provide an overall description of walking functionality. Therefore, we propose to describe the effects of multilevel surgery in children with CP, considering energetics, mechanical work, kinetic and kinematic of walking. We measured external, internal, total work, energy cost, recovery, efficiency, kinetic and kinematic of walking in 10 children with CP (4 girls, 6 boys; 13 years±2) before and 1 year after multilevel surgery. Kinetic and kinematic results are partially comparable to previous findings, energy cost of walking is significantly reduced ($p<0.05$); external, internal, total work, recovery, efficiency are not significantly different ($p=0.129$; $p=0.147$; $p=0.795$; $p=0.119$; $p=0.21$). The improvement of the walking's energy consumption is not accompanied by a corresponding improvement of mechanical work. Therefore it is conceivable that the improvement of walking economy depend on a reduced effort of the muscle to maintain the posture, rather than to an improvement of the mechanism of energy recovery typical of human locomotion.

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6. Gait Posture. 2014 Jul 21. pii: S0966-6362(14)00646-8. doi: 10.1016/j.gaitpost.2014.07.010. [Epub ahead of print]

Analysis of the relationships that body composition and muscular strength have with oxygen cost of walking in children with cerebral palsy.

Sison-Williamson M1, Bagley A2, Gorton G 3rd3, Johnson BA4, Oeffinger D5.

OBJECTIVE: To investigate whether body composition and lower extremity strength relate to oxygen cost of walking in children with cerebral palsy (CP), and to evaluate the relative contributions of these measures to explain variation in oxygen cost seen in this population. METHODS: A total of 116 children with spastic diplegic CP, Gross Motor Function Classification System levels I-III, aged 8-18 participated. Strength, body composition (body mass index (BMI) and percent body fat) and oxygen cost were recorded. Pearson correlations assessed relationships between variables of body composition and strength to oxygen cost. Forward stepwise linear regression analyzed variance explained by strength and body composition measures. Oxygen data were analyzed by weight status classifications using one-way analysis of variance with significance set at $p<0.05$. RESULTS: Total strength ($r=-0.27$) and total extensor strength ($r=-0.27$) had fair inverse relationships with oxygen cost. Total extensor strength explained 7.5% ($r^2=0.075$, $\beta=-0.274$, $p<0.01$) of the variance in oxygen cost. Body composition did not explain significant variance in oxygen cost, however significant differences were found in oxygen consumption ($p=0.003$) and walking velocity ($p=0.042$) based on BMI weight classifications. CONCLUSIONS: For ambulatory children with

CP, oxygen cost during walking can be partially explained by total extensor strength and not body composition. However, those categorized as obese may adjust to a slower walking speed to keep their oxygen cost sustainable, which may further affect their ability to keep up with typically developing peers and possibly lead to greater fatigue.

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7. Harefuah. 2014 May;153(5):266-72, 305.

Physical exercise for people with cerebral palsy: effects, recommendations and barriers [Article in Hebrew]

Barak S, Hutzler Y, Dubnov-Raz G.

The management goal of cerebral palsy (CP) is improving functionality, locomotion and independence. Treatment programs commonly encompass adapted physical activity (APA). This review summarizes the knowledge regarding the effects and recommendations for APA in persons with CP. In addition, barriers to APA in this population are reviewed. The available literature on benefits of APA to persons with CP has focused mainly on youth. The components of the APA programs generally consist of strength, aerobic and flexibility training. There is no empirical evidence that strength-training increases spasticity in people with CP. Furthermore, strength-training may increase strength and the ability to perform daily activities. Aerobic-training is especially important as persons with CP typically have low cardiorespiratory fitness and high prevalence of cardiac disease. However, limited published evidence exists on aerobic-training effects in this population. Nonetheless, the evidence suggests that aerobic-training in persons with CP can improve physiological outcomes, yet the influence of these changes on participation has not been investigated sufficiently. Stretching exercise is a common treatment for spasticity. Surprisingly, there is inconclusive evidence for the effectiveness of stretching exercise for persons with CP. Despite the importance attributed to APA for people with CP, low levels of physical activity have been reported in this population. However, when caregivers perceive greater benefits of exercise, individuals with CP are more likely to be active. In contrast, barriers to APA include costs of APA programs, limited means of transportation to APA facilities, lack of information regarding APA facilities and limited appropriate exercising equipment in the APA facilities.

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8. Res Dev Disabil. 2014 Aug 4;35(11):2840-2848. doi: 10.1016/j.ridd.2014.07.030. [Epub ahead of print]

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

Grecco LA1, Duarte ND2, Mendonça ME3, Cimolin V4, Galli M5, Fregni F6, Oliveira CS7.

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.

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9. Osteoporos Int. 2014 Aug 14. [Epub ahead of print]**Bone mineral density and vitamin D status in ambulatory and non-ambulatory children with cerebral palsy.**

Finbråten AK1, Syversen U, Skranes J, Andersen GL, Stevenson RD, Vik T.

This study assessed distal femur and lumbar spine bone mineral density (BMD) Z-scores in children with cerebral palsy. BMD z-score was lower in non-ambulatory than in ambulatory children. Somewhat surprisingly, among ambulatory children, those with better walking abilities had higher BMD z-score than those with more impaired walking ability. **INTRODUCTION:** Children with cerebral palsy (CP) have increased risk for low bone mineral density (BMD). The aim was to explore the difference in BMD at the distal femur and lumbar spine between ambulatory and non-ambulatory children with CP and the relationship between vitamin D status and BMD. **METHODS:** Fifty-one children (age range 8-18 years; 20 girls) with CP participated. Their BMD Z-scores were measured in the lumbar spine and the distal femur using dual X-ray absorptiometry, and 25-hydroxy-vitamin D (25-OHD) concentrations were measured in serum. Children with GMFCS level I-III were defined as 'walkers' while children with level IV-V were defined as 'non-walkers'. **RESULTS:** Non-walkers had lower mean BMD Z-scores (range -1.7 to -5.4) than walkers at all sites (range -0.8 to -1.5). Among walkers, BMD Z-scores at the distal femur were lower in those with GMFCS level II than with level I (*p* values < 0.004). A similar difference was found between the affected and unaffected limb in children with hemiplegia. Mean 25-OHD concentration was 45 nmol/L (SD = 18); lower in walkers (mean = 41 nmol/L; SD = 18) than in non-walkers (mean = 53 nmol/L; SD = 19; *p* = 0.041). There were no correlations between 25-OHD and BMD z-scores. **CONCLUSIONS:** The main predictor of low BMD Z-scores in the distal femur was the inability to walk, but the results suggest that the degree of the neuromotor impairment may also be a significant predictor. Vitamin D status did not correlate with BMD z-scores.

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10. Indian J Pediatr. 2014 Aug 9. [Epub ahead of print]**Comparison of Micronutrient Levels in Children with Cerebral Palsy and Neurologically Normal Controls.**

Kalra S1, Aggarwal A, Chillar N, Faridi MM.

OBJECTIVE: To measure levels of micronutrients in children with cerebral palsy and compare them with neurologically normal children of similar nutritional status. **METHODS:** Fifty children with cerebral palsy (2-12 y) and 50 age and sex matched controls of similar nutritional status were enrolled. Detailed dietary history was recorded and nutritional status assessed. Venous blood (3 ml) was drawn for analysis. Micronutrient levels were measured as per standard technique. **RESULTS:** Serum iron was 12.6 ± 5.9 and 20.9 ± 3.3 $\mu\text{mol/L}$ in CP and controls respectively (*P* < 0.001). Mean copper levels were 106.2 ± 38.3 $\mu\text{g/dl}$ in CP and 128.8 ± 20.2 $\mu\text{g/dl}$ in controls (*P* < 0.001); magnesium levels were 1.97 ± 0.4 and 2.2 ± 0.3 mg/dl (*P* = 0.003). Zinc levels were similar in CP and controls (*P* = 0.979). The mean energy intake was significantly less in CP (*P* = 0.016). Mean protein intake did not vary significantly (*P* = 0.847). No correlation was found between energy intake and serum levels of micronutrients (*P* > 0.05). There was no difference in micronutrient levels with respect to gross motor functional classification system (GMFCS) grades and limb involvement (*P* > 0.05). **CONCLUSIONS:** The serum levels of iron, copper and magnesium are significantly less in children with cerebral palsy, hence the need for supplementation.

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11. Codas. 2014 Jun;26(3):213-8.**Global developmental abilities of cochlear implanted children with spastic cerebral palsy: two experimental groups [Article in English, Portuguese]**

Lamônica DA1, Santos MJ1, Paiva CS1, Silva LT2.

PURPOSE: To analyze gross motor, fine motor-adaptive, language, social function performance, and communicative behaviors among cochlear-implanted children with spastic cerebral palsy (CP) and children with CP without hearing loss (HL) and to compare them with children with normal development. **METHODS:** Prospective

cross-sectional study involving 12 children with mean age of 63 months, distributed into two experimental groups: G1 - 4 children with CP and cochlear implant (CI) users and G2 - 4 children with CP without HL. A third group (G3) was the control group with four typically developing children. In the experimental groups, six children were classified in level II and two in level IV, using the Gross Motor Function Classification System. We used the Denver Developmental Screening Test II and the Communicative Behavior Observation (CBO). RESULTS: G3 showed better performance than G1 and G2 in all evaluations. G2 showed better results than G1 in language, communication, personal-social, and fine motor-adaptive areas, except in the gross motor area. Aspects of language and communicative behaviors were lower in both experimental groups, especially in G1. Skills related to personal-social area showed no differences among the groups. CONCLUSION: Motor impairment of G1 and G2 and HL in G1 affected the development in the assessed areas, but these factors did not restrict personal-social development. Children with CP did not achieve high development in social function; however, the difference with relation to G3 was not statically significant. The CI provided a channel for oral language reception and social interaction, which has a key role in determining the quality of life.

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12. Arch Pediatr. 2014 Aug 4. pii: S0929-693X(14)00229-2. doi: 10.1016/j.arcped.2014.04.032. [Epub ahead of print]

Detection of executive function disorders with a standard neurodevelopmental follow-up of premature children [Article in French]

Monnier M1, Jaunin L2, Bickle Graz M2, Borradori Tolsa C3, Hüppi P3, Sancho Rossignol A3, Barisnikov K4, Forcada Guex M2.

INTRODUCTION: A significant proportion of prematurely born children encounter behavioral difficulties, such as attention deficit or hyperactivity, which could be due to executive function disorders. **AIMS:** To examine whether the standard neurodevelopmental assessment offered to premature children in Switzerland recognizes executive function disorders. **METHODS:** The study population consisted of 49 children born before 29 weeks of gestation who were examined between 5 and 6 years of age with a standard assessment, with additional items to assess executive functioning. Children with severe neurodevelopmental impairment were excluded (mental retardation, cerebral palsy, autism). Standard assessment consisted in the Kaufman Assessment Battery for Children (K-ABC), which comprises three subscales: sequential processes (analysis of sequential information), simultaneous processes (global analysis of visual information), and composite mental processes (CMP) (result of the other two scales), as well as a behavioral evaluation using the standardized Strengths and Difficulties Questionnaire (SDQ). Executive functioning was assessed with tasks evaluating visual attention, divided attention, and digit memory as well as with a specialized questionnaire, the Behavior Rating Index of Executive Functions (BRIEF), which evaluates several aspects of executive function (regulation, attention, flexibility, working memory, etc). **RESULTS:** Children were divided according to their results on the three K-ABC scales (< or >85), and the different neuropsychological tasks assessing executive function were compared between the groups. The CMP did not differentiate children with executive difficulties, whereas a score <85 on the sequential processes was significantly associated with worse visual and divided attention. There was a strong correlation between the SDQ and the BRIEF questionnaires. For both questionnaires, children receiving psychotherapy had significantly higher results. Children who presented behavioral problems assessed with the SDQ presented significantly higher scores on the BRIEF. **CONCLUSION:** A detailed analysis of the standard neurodevelopmental assessment allows the identification of executive function disorders in premature children. Children who performed below 85 on the sequential processes of the K-ABC had significantly more attentional difficulties on the neuropsychological tasks and therefore have to be recognized and carefully followed. Emotional regulation had a strong correlation with behavioral difficulties, which were suitably assessed with the SDQ, recognized by the families, and treated.

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13. Seizure. 2014 Jul 25. pii: S1059-1311(14)00211-8. doi: 10.1016/j.seizure.2014.07.012. [Epub ahead of print]

Epilepsy, comorbid conditions in Canadian children: Analysis of cross-sectional data from Cycle 3 of the National Longitudinal Study of Children and Youth.

Prasad AN1, Burneo JG2, Corbett B2.

PURPOSE: The purpose of this study was to analyze national survey data to provide estimates of prevalence of epilepsy and associated developmental disabilities and comorbid conditions. **METHODS:** We analyzed data from Cycle 3 of Canada's National Longitudinal Survey of Children and Youth. The NLSCY captured, socio-demographic information, as well as age, sex, education, ethnicity, household income, chronic health related conditions from birth to 15 years old. The main survey question intended to identify "epilepsy", "cerebral palsy", "intellectual disability", "learning disability", and "emotional and nervous difficulties" in the population of children surveyed. Prevalence was based on the national cross-sectional sample and used 1000 bootstrap weights to account for survey design factors. **RESULTS:** Cycle 3 of the NLSCY had the largest number of patients with diagnosed epilepsy. Prevalence figures (n/1000) for epilepsy and cerebral palsy (EPI_CP), epilepsy and intellectual disability (EPI_ID), epilepsy and learning disability (EPI_LD), and epilepsy and emotional nervous difficulties (EPI_EMO_NERV) were 1.1, 1.17, 2.58 and 1.34 respectively. Amongst children with epilepsy, 43.17% reported the presence of one or more of the above comorbid conditions. **CONCLUSION:** These results provide an initial prevalence estimate of comorbid conditions with epilepsy in Canadian children. In a high proportion of children with epilepsy, the PMK had reported at least one comorbid disorder. These findings carry implications for health care utilization and long-term outcomes. We discuss methodological aspects related to the ascertainment of epilepsy in both surveys, and to the validity and implications of our findings.

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14. Dev Med Child Neurol. 2014 Sep;56(9):800. doi: 10.1111/dmcn.12554.

To boldly go.

Fehlings D.

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Prevention and Cure

15. Comput Math Methods Med. 2014;2014:965275. doi: 10.1155/2014/965275. Epub 2014 Jul 13.

Mathematical modelling of cerebral blood circulation and cerebral autoregulation: towards preventing intracranial hemorrhages in preterm newborns.

Lampe R1, Botkin N2, Turova V1, Blumenstein T1, Alves-Pinto A1.

Impaired cerebral autoregulation leads to fluctuations in cerebral blood flow, which can be especially dangerous for immature brain of preterm newborns. In this paper, two mathematical models of cerebral autoregulation are discussed. The first one is an enhancement of a vascular model proposed by Piechnik et al. We extend this model by adding a polynomial dependence of the vascular radius on the arterial blood pressure and adjusting the polynomial coefficients to experimental data to gain the autoregulation behavior. Moreover, the inclusion of a Preisach hysteresis operator, simulating a hysteretic dependence of the cerebral blood flow on the arterial pressure, is tested. The second model couples the blood vessel system model by Piechnik et al. with an ordinary differential equation model of cerebral autoregulation by Ursino and Lodi. An optimal control setting is proposed for a simplified variant of this coupled model. The objective of the control is the maintenance of the autoregulatory

function for a wider range of the arterial pressure. The control can be interpreted as the effect of a medicament changing the cerebral blood flow by, for example, dilation of blood vessels. Advanced numerical methods developed by the authors are applied for the numerical treatment of the control problem.

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16. J Dev Orig Health Dis. 2012 Apr;3(2):116-22. doi: 10.1017/S2040174411000766.

Developmental outcome in preterm infants <29 weeks gestation with \leq Stage 3 retinopathy of prematurity (ROP): relationship to severity of ROP.

Todd DA1, Goyen TA2, Smith J3, Rochefort M2.

We have determined the influence of the severity of retinopathy of prematurity (ROP) on development at 3 years of age in infants <29 weeks gestation from a population-based cohort. Primary analysis of surviving infants born <29 weeks gestational age (GA) from 1998 to 2001 in New South Wales and the Australian Capital Territory were grouped according to stage of ROP. Infants with periventricular leukomalacia, Grade III or IV intraventricular haemorrhage, hydrocephalus, major congenital abnormalities, Stage 4 or 5 ROP, cerebral palsy or a severe hearing impairment were excluded. Infants with Stage 3 ROP were matched for GA, birthweight and gender to those with no ROP, Stage 1 and Stage 2 ROP. The four groups were then compared for their 3-year-old developmental outcome, using the Griffiths Mental Development Scale. Development was also compared for those infants with Stage 3 ROP who were either treated or not treated with laser therapy. A secondary multivariate regression analysis on developmental outcome was performed with all infants included in the analysis. In neurologically comparable groups and in the multivariate analysis, there was no association between ROP and developmental outcome. There was also no difference in the Griffiths assessment at 3 years between those who were or were not treated for severe ROP. Neither severity of ROP nor treatment for severe ROP were related to developmental outcome at 3 years of age in a large population-based cohort of infants born <29 weeks gestation.

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17. Neuroradiology. 2014 Aug 14. [Epub ahead of print]

The effects of hemorrhagic parenchymal infarction on the establishment of sensori-motor structural and functional connectivity in early infancy.

Arichi T1, Counsell SJ, Allievi AG, Chew AT, Martinez-Biarge M, Mondì V, Tusor N, Merchant N, Burdet E, Cowan FM, Edwards AD.

INTRODUCTION: The objective of the study was to characterize alterations of structural and functional connectivity within the developing sensori-motor system in infants with focal perinatal brain injury and at high risk of cerebral palsy. **METHODS:** Functional magnetic resonance imaging (fMRI) and diffusion tensor imaging (DTI) data were used to study the developing functional and structural connectivity framework in six infants born prematurely at term equivalent age. This was first characterised in three infants without focal pathology, which was then compared to that derived from three infants with unilateral haemorrhagic parenchymal infarction and a subsequent focal periventricular white matter lesion who developed later hemiparesis. **RESULTS:** Functional responses to passive hand movement were in the contralateral perirolandic cortex, regardless of focal pathology. In infants with unilateral periventricular injury, afferent thalamo-cortical tracts appeared to have developed compensatory trajectories which circumvented areas of damage. In contrast, efferent corticospinal tracts showed marked asymmetry at term equivalent age following focal brain injury. Sensori-motor network analysis suggested that inter-hemispheric functional connectivity is largely preserved despite pathology and that impairment may be associated with adverse neurodevelopmental outcome. **CONCLUSION:** Following focal perinatal brain injury, altered structural and functional connectivity is already present and can be characterized with MRI at term equivalent age. The results of this small case series suggest that these techniques may provide valuable new information about prognosis and the pathophysiology underlying cerebral palsy.

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