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Interventions and Management

1. BMC Pediatr. 2012 Jul 2;12(1):90. [Epub ahead of print]

Physiotherapists' experiences of physiotherapy interventions in scientific physiotherapy publications focusing on interventions for children with cerebral palsy: a qualitative phenomenographic approach.

Larsson I, Miller M, Liljedahl K, Gard G.

BACKGROUND: Physiotherapy research concerning interventions for children with CP is often focused on collecting evidence of the superiority of particular therapeutic methods or treatment modalities. Articulating and documenting the use of theory, instrumentation and research design and the assumptions underlying physiotherapy research interventions are important. Physiotherapy interventions focusing on children with Cerebral Palsy should, according to the literature, be based on a functional and environmental perspective with task-specific functional activity, motor learning processes and Family-Centred Service i.e. to enhance motor ability and improve capacity so that the child can perform the tasks necessary to participate actively in everyday life. Thus, it is important to coordinate the norms and values of the physiotherapist with those of the family and child. The aim of this study was to describe how physiotherapists' experiences physiotherapy interventions for children with CP in scientific physiotherapy publications written by physiotherapists. **METHODS:** A qualitative phenomenographic approach was used. Twenty- one scientific articles, found in PubMed, strategically chosen according to year of publication (2001-2009), modality, journals and country, were investigated. **RESULTS:** Three qualitatively different descriptive categories were identified: A: Making it possible a functional-based intervention based on the biopsychosocial health paradigm, and the role of the physiotherapist as collaborative, interacting with the child and family in goal setting, intervention planning and evaluation, B: Making it work an impairment-based intervention built on a mixed health paradigm (biomedical and biopsychosocial), and the role of the physiotherapist as a coach, leading the goal setting, intervention planning and evaluation and instructing family members to carry out physiotherapist directed orders, and; C: Making it normal an impairment-based intervention built on a biomedical health paradigm, and the role of the physiotherapist as an authoritative expert who determine goals, intervention planning and evaluation. **CONCLUSIONS:** Different paradigms of health and disability lead to different approaches to physiotherapy which influence the whole intervention process regarding strategies for the assessment and treatment, all of which influence Family-Centred Service and the child's motor learning strategies. The results may deepen physiotherapists' understanding of how different paradigms of health influence the way in which various physiotherapy approaches in research seek to solve the challenge of CP.

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2. Gait Posture. 2012 Jul 3. [Epub ahead of print]**Long-term outcome of femoral derotation osteotomy in children with spastic diplegia.**

Dreher T, Wolf SI, Heitzmann D, Swartman B, Schuster W, Gantz S, Hagmann S, Döderlein L, Braatz F.

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Satisfactory short-term results after femoral derotation osteotomy (FDO) for the treatment of internal rotation gait in cerebral palsy have been reported by various authors. However, there are only a few longer-term studies reporting results 5 years after FDO and these are not in agreement. There are no reports on the clinical course beyond the pubertal growth spurt. 33 children with diplegia (n=59 legs, age: 10.5±3.6 years) and internally rotated gait were examined pre- (E0), 1 year (E1), 3±1 (E2) and 9±2 (E3) years after distal (27 legs) or proximal (32 legs) FDO as part of multilevel surgery, using standardized clinical exam and 3D gait-analysis at all examinations. The amount of intra-operative derotation averaged 25°. ANOVA was used for statistics (p<0.05). Mean hip internal rotation in stance at E0 of 17.3° was significantly changed to 1.0° of external rotation at E1 and was maintained at 4.2° at E3. The same clinical course was found for foot progression angle. The mid-point of passive hip rotation at E0 was 21°. This was significantly decreased to 6° at E1 and showed a small but significant increase reaching 12° at E3. The results of this study showed a good overall correction of internally rotated gait following FDO. These improvements were maintained at long-term follow-up after the pubertal growth spurt. Recurrence was observed in some cases with overall severe deterioration. In those patients persistent dynamic factors leading to recurrence should be further investigated.

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3. Res Dev Disabil. 2012 Jun 27;33(6):1996-2003. [Epub ahead of print]**Increased mechanical cost of walking in children with diplegia: The role of the passenger unit cannot be neglected.**

Van de Walle P, Halleman A, Truijen S, Gosselink R, Heyrman L, Molenaers G, Desloovere K.

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Gait efficiency in children with cerebral palsy is decreased. To date, most research did not include the upper body as a separate functional unit when exploring these changes in gait efficiency. Since children with spastic diplegia often experience problems with trunk control, they could benefit from separate evaluation of the so-called 'passenger unit'. Therefore, the aim of the current study was to improve insights in the role of the passenger unit in decreased gait efficiency in children with diplegia. Mechanical cost of walking was investigated by calculating work by the integrated joint power approach in 18 children with diplegia and 25 age-related typical developing controls. The total mechanical work in children with diplegia was 1.5 times higher than in typical children. In children with diplegia work at the lower limbs was increased by 37% compared to typical children. Substantially higher increases, up to 222%, were noted at the passenger unit. Trunk and head were the main contributors to the increased work of the passenger unit, but the role of the arms cannot be neglected. Due to these disproportional increases in locomotor and passenger unit, the demands of the passenger unit in pathological gait can no longer be considered minor, as in typical gait. Therefore, the role of the passenger unit must be recognized in the decrease of gait efficiency in children with spastic diplegia and should be part of the evaluation of gait efficiency in clinical practice.

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4. Dev Med Child Neurol. 2012 Jul 6. doi: 10.1111/j.1469-8749.2012.04334.x. [Epub ahead of print]**Improving upper limb motor functions through action observation treatment: a pilot study in children with cerebral palsy.**

Buccino G, Arisi D, Gough P, Aprile D, Ferri C, Serotti L, Tiberti A, Fazzi E.

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Aim: The aim of this randomized controlled trial was to assess whether action observation treatment may improve upper limb motor functions in children with cerebral palsy (CP). **Method** All children with CP admitted to our unit for rehabilitation from May 2009 to May 2010 were eligible. Inclusion criteria were age between 6 years and 11 years, an IQ of at least 70, and no major visual and/or auditory deficits. Fifteen children were enrolled and randomly assigned to either a case group (n=8; four males, four females; median age 7y 6mo) or control group (n=7; five males, two females; median age 8y). Six participants had left-sided hemiplegia, six right-sided hemiplegia, and three had tetraplegia; 10 were independent walkers. Those in the case group were asked to observe video clips showing daily age-appropriate actions, and afterwards to imitate them. Participants in the control group were asked to observe video clips with no motor content and afterwards to execute the same actions as cases. The primary outcome measure was the Melbourne Assessment Scale. Children were scored twice at baseline (2wks apart), and at the end of treatment, by a physician blind to group assignment. **Results** At baseline groups did not differ on functional evaluation. After treatment, the functional score gain (Δ) was significantly different in the case and control groups (p=0.026). **Interpretation** The present results support the notion that action observation treatment can be an effective part of the rehabilitation programme in children with CP.

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5. BMC Pediatr. 2012 Jul 2;12(1):91. [Epub ahead of print]**Effectiveness of resistance training in combination with botulinum toxin-A on hand and arm use in children with cerebral palsy: A pre-post intervention study.**

Elvrum AK, Brændvik SM, Sæther R, Lamvik T, Vereijken B, Roeleveld K.

BACKGROUND: The aim of this study was to investigate effects of additional strength training after use of Botulinum Toxin-A (BoNT-A) in the upper limbs of children with cerebral palsy (CP). **METHODS:** Ten children with CP (range 9 - 17 years, Manual Ability Classification System II) with unilaterally affected upper limbs were assigned to two intervention groups. One group received BoNT-A treatment (group B), the other BoNT-A plus 8 weeks strength training (group BT). Hand activity was measured with Melbourne assessment of unilateral upper limb function (Melbourne) and Assisting Hand Assessment (AHA). Measures of muscle strength, muscle tone, and active range of motion were used to assess neuromuscular body function. Measurements were performed before and two and five months after intervention start. Change scores and differences between the groups in change scores were statistically tested in SPSS version 18, using Mann-Whitney U test and Wilcoxon Signed Rank test, respectively. **RESULTS:** Both groups had very small improvements in AHA and Melbourne two months after BoNT-A injections, without differences between groups. There were significant, or close to significant, short-term treatment effects in favour of group BT for muscle strength in injected (elbow flexion strength, p=0.08) and non-injected muscles (elbow extension and supination strength, both p=0.05), without concomitant increases in muscle tone. Active supination range improved in both groups but more so in group BT (p= 0.09). There were no differences between the groups three months after training ended. **CONCLUSIONS:** Strength training strengthens non-injected muscles temporarily and may reduce short term strength loss that results from BoNT-A injections without increasing muscle tone. Moreover, additional strength training may increase active range of motion to a larger extent than BoNT-A alone. None of the improvements in neuromuscular body functions further improved hand activity. Larger clinical trials are needed to further investigate whether strength training can counteract strength loss caused by BoNT-A, whether the combination of BoNT-A and strength training is superior to BoNT-A or strength training alone in improving active range of motion, and whether more task-related strength training is a more effective approach to improve hand activity.

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6. Dev Neurorehabil. 2012 Jul 3. [Epub ahead of print]

Handedness in diplegic cerebral palsy.

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Objective: To determine if the frequency of left-handedness is high in children with spastic cerebral diplegia. **Design:** Case-control study. **Methods:** One hundred and eleven children with spastic diplegic cerebral palsy and 444 age- and gender-matched controls were studied. The handedness of each child was assigned on the basis of responses to questions on the hand preference for writing and drawing, feeding and throwing a ball. The data were analysed by conditional logistic regression and computing the odds ratio and 95% confidence intervals for left handedness. **Results:** Of the 111 children with spastic diplegic cerebral palsy, 45 were left-handed, while 13 of 444 normal children were left-handed. The odds ratio for left-handedness in children with diplegic cerebral palsy as compared to normal children was 27.33 (95% CI = 11.63, 64.25). **Conclusion:** The study shows that left-handedness is very frequently encountered in children with spastic diplegic cerebral palsy.

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7. Res Dev Disabil. 2012 Jun 30;33(6):2058-2066. [Epub ahead of print]

Assessing true and false belief in young children with cerebral palsy through anticipatory gaze behaviours: A pilot study.

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Children with a clinical description of cerebral palsy (CP) commonly experience cognitive and sensory difficulties that co-occur with motor impairment, and for some children this can include impairments in social communication. While research has begun to examine theory of mind abilities in children with CP, relatively little is known about social communication difficulties in this population. Assessing theory of mind abilities in children with CP using traditional procedures such as the classic Sally-Anne task can be problematic if performance is affected by physical difficulties in signalling responses and/or by cognitive and language demands inherent to the task itself. The central aim of this study therefore was to examine the potential of using a new action anticipation task and eye-tracking technique to assess implicit true and false belief understanding in four developmentally young children with quadriplegic cerebral palsy who had little or no functional speech, and one language age matched child with Down syndrome who did not have severe motor impairment. All children in this study consistently demonstrated anticipatory gaze behaviours in the context of the true belief task. One child with CP and the child with Down syndrome demonstrated anticipatory gaze behaviours indicative of an ability to attribute false belief. The findings are discussed in relation to the application of action anticipation and eye-tracking paradigms in research and clinical practice.

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8. Int Ophthalmol. 2012 Jul 1. [Epub ahead of print]**Bilateral proptosis in a child with vitamin C deficiency.**

Saha P, Pal RB, Das I, Sinha MK.

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Scurvy is one of the oldest diseases known to mankind, caused by vitamin C deficiency. Nowadays it exists primarily in certain vulnerable populations such as patients with neurodevelopmental disabilities. Proptosis due to orbital haemorrhage is a rare complication of scurvy. Here we describe a case of diaphragic cerebral palsy presented with sudden onset of bilateral proptosis and swollen and tender knee joints. Subsequent computed tomography of the orbit revealed hematoma in the superior aspect of both orbits in the extraconal position. X-ray of the knee joints revealed bony changes consistent with scurvy. After 6 weeks of treatment with vitamin C orally, the proptosis and the bony changes returned to normal. Although scurvy is a rare disease in the general pediatric population, it still exists in certain vulnerable populations like neurologically disabled ones, and this uncommon cause for proptosis should be considered in such children.

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9. Eur Child Adolesc Psychiatry. 2012 Jun 30. [Epub ahead of print]**Mental health at 5 years among children born extremely preterm: a national population-based study.**

Elgen SK, Leversen KT, Grundt JH, Hurum J, Sundby AB, Elgen IB, Markestad T.

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The objective of this study was to compare mental health at 5 years in children born extremely preterm with a reference group, and assess associations between functional abilities and mental health within the preterm group. In a national Norwegian cohort with gestational age 22-27 weeks or birthweight 500-999 g, mental health was assessed with the Strengths and Difficulties Questionnaire (SDQ), cognitive function with the Wechsler Preschool and Primary Scale of Intelligence-Revised (WPPSI-R), motor function with the Movement Assessment Battery for children (ABC-test) and severity of cerebral palsy (CP) with the Gross Motor Function Classification for CP (GMFCS). Neurodevelopmental disabilities (NDD) were described as mild and moderate/severe. SDQ of the preterm children was compared with that of an unselected reference group. SDQ sub-scores ≥ 90 th percentile of the reference group were defined as a mental health problem and a Total Difficulties Score ≥ 90 th percentile (TDS90) as suggestive of psychiatric disorder. Of 361 eligible preterm children, parents completed SDQ for 255 (71 %). 97 (38 %) had TDS90 compared to 116 (11 %) of the reference group (OR 5.1; 95 % CI 3.7-7.1). For the preterms, the rate of TDS90 was higher for those with moderate/severe NDD (27/37 vs. 27/116, adjusted OR 8.0; 95 % CI 3.2-19, and mild NDD 43/102 [adjusted OR 2.2 (1.2-4.1)]. For preterms with no NDD, TDS90 was more common than for the reference group (27/116 vs. 116/1,089, OR 2.5; 95 % CI 1.6-4.1). Extreme prematurity was associated with increased risk of later mental health problems, particularly if they had other functional impairments.

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10. Rev Bras Enferm. 2012 Feb;65(1):104-9.**Family perception on the disease and physiotherapeutic care of individuals with cerebral palsy [Article in Portuguese]**

Mello R, Ichisato SM, Marcon SS.

Universidade Estadual do Centro-Oeste do Paraná, Guarapuava, PR, Brasil.

The study aimed to know the perception of the family on the disease and physiotherapeutic care of individuals with Cerebral Palsy. Data was collected through semi-structured interview with 24 caretakers of children with Cerebral

Palsy who are assisted at the APAE of Guarapuava -PR. The results showed that half of the children were quadriplegic and aphasic and that most of them presented dependence of care on their daily life activities. The mothers / caretakers revealed do not know the base pathology, as well as the physiotherapeutic treatment that is accomplished for their children in the institution. It is concluded that there is a need of strategies to promote more interaction between family and health professionals, making possible the caretaker to better participate on the treatment, and consequently, to learn and put into practice beneficial activities for the child.

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11. Eur J Paediatr Neurol. 2012 Jun 29. [Epub ahead of print]

Item hierarchy of the Chinese version of cerebral palsy quality of life for children.

Sam KL, Wang HY, Li C, Lo SK.

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BACKGROUND: The Chinese Cerebral Palsy Quality of Life for Children (C CP QOL-Child) is the first instrument developed to measure quality of life of (QOL) children with cerebral palsy in Chinese speaking populations. **OBJECTIVE:** The aim of the study was to examine the psychometric properties of C CP QOL-Child using Item Response Theory Models. We were particularly interested to know how intervention strategies could be designed for individuals based on the item scores. **METHODS:** 145 primary caregivers (mostly mothers; mean age: 39.2) of children with cerebral palsy aged 4-12 were invited to complete the 65-item C CP QOL-Child questionnaire. Data were analyzed using Rasch analysis. **RESULTS:** Item difficulty estimates were aligned with person ability values, indicating that the items in the scale generally demonstrated an appropriate depth and width for measuring QOL of persons in the target population. The results also showed that after dropping the 8 items in the dimension pain and impact of disability in the 65-item scale, the revised 57-item scale exhibits unidimensionality (separation index = 4.43, $r = 0.95$); hence the total score computed from the 57 items adequately reflects the level of QOL of the child as perceived by the caregiver. We further found that the Rasch item difficulty estimates demonstrated an overall item hierarchy; hence therapists can expect a pattern of performance by a child with CP that is based on the established order of item difficulty. **CONCLUSIONS:** The hierarchical structure identified in the study may be useful for designing tailor-made interventions with an aim of improving QOL.

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Prevention and Cure

12. Pediatr Neurol. 2012 Aug;47(2):147-9.

Molybdenum cofactor deficiency mimics cerebral palsy: differentiating factors for diagnosis.

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We describe an infant with molybdenum cofactor deficiency, initially diagnosed as cerebral palsy. Clinical features of molybdenum cofactor deficiency, e.g., neonatal seizures, hypertonus/hypotonus, and feeding and respiratory difficulties, resemble those of neonatal hypoxic-ischemic encephalopathy. Our patient, a 2-year-old boy, presented with spastic quadriplegia and mental retardation. He manifested intractable neonatal seizures and diffuse cerebral atrophy. When admitted with bronchitis at age 18 months, his uric acid levels in blood and urine were undetectable. A urinary sulfite test revealed positive results. Further tests revealed elevated urinary levels of xanthine, hypoxanthine, and S-sulfocystein. Sequencing of the MOCS2A gene revealed heterozygosity for c.[265T>C] + [266A>G], diagnosed as molybdenum cofactor deficiency type B. Neonatal seizures, progressive cerebral atrophy,

and low serum levels of uric acid may provide diagnostic clues in patients with cerebral palsy of undetermined cause.

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13. *Pediatr Neurol*. 2012 Aug;47(2):101-8.

Quantitative cranial magnetic resonance imaging in neonatal hypoxic-ischemic encephalopathy.

Mulkey SB, Yap VL, Swearingen CJ, Riggins MS, Kaiser JR, Schaefer GB.

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The volume of acute injury detected by diffusion-weighted imaging and quantitative brain growth on serial cranial magnetic resonance imaging was not previously used to predict neurodevelopmental outcomes in infants with neonatal hypoxic-ischemic encephalopathy treated with head cooling. Our longitudinal study involved 16 head-cooled term infants with hypoxic-ischemic encephalopathy who underwent early and follow-up cranial magnetic resonance imaging and follow-up neurologic evaluations, out of 105 infants who received therapeutic hypothermia. The volume of acute injury was measured on initial cranial magnetic resonance imaging, using diffusion-weighted images. Total brain volumes were measured in both early and follow-up magnetic resonance imaging studies. Acute injury volume in the corpus callosum $>0.5 \text{ cm}^3$ was associated with developing epilepsy (odds ratio, 20; 95% confidence interval, 1.01-1059.6; $P = 0.013$). Follow-up whole brain volume was reduced in those with unfavorable outcomes (i.e., epilepsy, cerebral palsy, and delayed developmental milestones), compared with infants without all three outcomes. Although acute brain injury volume and brain growth measurements may be useful predictors of outcomes in neonatal hypoxic-ischemic encephalopathy, the evolution of brain injury in these infants has yet to be fully understood and should be studied prospectively.

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14. *Dev Neurobiol*. 2012 Jun 29. doi: 10.1002/dneu.22045. [Epub ahead of print]

Placental regulation of maternal-fetal interactions and brain development.

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A variety prenatal insults are associated with the incidence of neurodevelopmental disorders such as schizophrenia, autism and cerebral palsy. While the precise mechanisms underlying how transient gestational challenges can lead to later life dysfunctions are largely unknown, the placenta is likely to play a key role. The literal interface between maternal and fetal cells resides in the placenta, and disruptions to the maternal or intrauterine environment are necessarily conveyed to the developing embryo via the placenta. Placental cells bear the responsibility of promoting maternal tolerance of the semi-allogeneic fetus and regulating selective permeability of nutrients, gases and antibodies, while still providing physiological protection of the embryo from adversity. The placenta's critical role in modulating immune protection and the availability of nutrients and endocrine factors to the offspring implicates its involvement in autoimmunity, growth restriction and hypoxia, all factors associated with the development of neurological complications. In this review, we summarize primary maternal-fetal interactions that occur in the placenta and describe pathways by which maternal insults can impair these processes and disrupt fetal brain development. We also review emerging evidence for placental dysfunction in the prenatal programming of neurodevelopmental disorders. © 2012 Wiley Periodicals, Inc. *Develop Neurobiol*, 2012.

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15. J Child Neurol. 2012 Jun 29. [Epub ahead of print]**Congenital Brain Damage: Cognitive Development Correlates With Lesion and Electroencephalographic Features.**

Riva D, Franceschetti S, Erbetta A, Baranello G, Esposito S, Bulgheroni S.

The purpose of this study was to assess cognitive development in 26 children with congenital focal brain lesion and unilateral spastic cerebral palsy first diagnosed and followed up for rehabilitation at our institution. Mean intelligence quotients (IQs) were correlated not only to the different features of the cerebral lesions, but also to the different types of electroencephalographic abnormalities. We also examined individual scores. We found that about 70% of the children had values of full, verbal, and performance IQs within the normal range. No differences were found between left and right injured children. Different Verbal IQ-Performance IQ profiles were observed. Larger lesions and some electroencephalographic features, mainly signal slowing/attenuation as signs of structural brain damage, were significantly associated with lower intellectual abilities. The role of other factors, including genetic and environmental background variability, as well as rehabilitative treatments, on cognitive sequelae in such patients was discussed.

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16. Early Hum Dev. 2012 Jun 29. [Epub ahead of print]**Obstetric brachial plexus lesions and central developmental disability.**

Buitenhuis S, van Wijlen-Hempel RS, Pondaag W, Malessy MJ.

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AIMS: First, to assess whether children with an Obstetric Brachial Plexus Lesion (OBPL) have a higher incidence of Central Developmental Disability (CDD) compared to the general population. Second, to test the ability of General Movements (GMs) to identify CDD children already at three months of age. **STUDY DESIGN:** A prospective cohort study for infants referred to our tertiary nerve lesion clinic. **SUBJECTS:** A prospective cohort study of 38 infants with OBPL followed until 5years (mean age). **OUTCOME:** Measures quality of fidgety GMs at 3months; presence or absence of CDD at a mean age of 5years; severity of the brachial plexus lesion. **RESULTS:** Five patients (13%) had CDD: one patient had a cerebral palsy and four showed definite other motor and/or mental problems. There was no correlation between the quality of the GMs at three months and CDD. There was no correlation between the severity of the nerve lesion and CDD. We found a correlation between quality of the GMs and severity of the nerve lesion. **CONCLUSION:** Children with OBPL have a high incidence of CDD. In our cohort fidgety GMs had no predictive value for CDD at a later age.

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