

Monday 24 March 2014

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## Interventions and Management

### 1. BMC Neurol. 2014 Mar 19;14(1):52. [Epub ahead of print]

#### **Arm hand skilled performance in cerebral palsy: activity preferences and their movement components.**

Lemmens RJ, Janssen-Potten YJ, Timmermans AA, Defesche A, Smeets RR, Seelen HA.

**BACKGROUND:** Assessment of arm-hand use is very important in children with cerebral palsy (CP) who encounter arm-hand problems. To determine validity and reliability of new instruments to assess actual performance, a set of standardized test situations including activities of daily living (ADL) is required. This study gives information with which such a set for upper extremity skill research may be fine-tuned, relative to a specific research question. Aim of this study is to a) identify upper extremity related ADL children with CP want to improve on, b) determine the 10 most preferred goals of children with CP, and c) identify movement components of all goals identified. **METHOD:** The Canadian Occupational Performance Measure was used to identify upper extremity-related ADL preferences (goals) of 53 children with CP encountering arm-hand problems (mean age 9 +/- 4.5 year). Goals were ranked based on importance attributed to each goal and the number of times a goal was mentioned, resulting in a gross list with goals. Additionally, two studies were performed, i.e. study A to determine the 10 most preferred goals for 3 age groups (2.5-5 years; 6-11 years, 12-19 years), based on the total preference score, and study B to identify movement components, like reaching and grasping, of all goals identified for both the leading and the assisting arm-hand. **RESULTS:** Seventy-two goals were identified. The 10 most preferred goals differed with age, changing from dressing and leisure-related goals in the youngest children to goals regarding personal care and eating for children aged 6-11 years. The oldest children preferred goals regarding eating, personal care and computer use. The movement components 'positioning', 'reach', 'grasp', and 'hold' were present in most tasks. 'Manipulating' was more important for the leading arm-hand, whereas 'fixating' was more important for the assisting arm-hand. **CONCLUSION:** This study gave insight into the preferences regarding ADL children with CP would like to improve on, and the movement components characterizing these activities. This information can be used to create a set of standardized test situations, which can be used to assess the validity and reliability of new measurement instruments to gauge actual arm-hand skilled performance.

[PMID: 24646071](https://pubmed.ncbi.nlm.nih.gov/24646071/) [PubMed - as supplied by publisher]

**2. Hand Surg. 2014;19(1):69-76. doi: 10.1142/S0218810414500129.****Simultaneous four finger metacarpophalangeal joint fusions - indications and results.**

Ledgard JP1, Tonkin MA.

**Purpose:** To review the results and indications of simultaneous four finger metacarpophalangeal joint fusions. **Methods:** The clinical records and X-rays of nine patients undergoing the above procedure were reviewed. The indication for surgery was to reverse severe metacarpophalangeal joint flexion deformities in eight patients, and following a traumatic four finger amputation in one. Seven patients returned for follow-up assessment. The fusions were performed with a tension band wire technique, aiming for 20 degrees of flexion for index and middle fingers and 40 degrees in the ring and little fingers. Time to radiological fusion and position of fusion, and improvement in function and appearance were assessed. **Results:** All joints were radiologically fused between six and 12 weeks. The average position of fusion of index and middle fingers was 20 degrees (range: 15-30) and ring and little fingers was 40 degrees (range: 35-50). Appearance was improved in all patients. Improved function was reported by four patients, and improved ease of hygiene and general care in four patients with non-functioning or poorly functioning hands. **Discussion:** Simultaneous fusion of all four finger metacarpophalangeal joints may be considered as a primary procedure to reconstruct destroyed metacarpophalangeal joints due to inflammatory arthropathy or trauma, and for inability to correct deformity or maintain the correction with soft tissue procedures for patients with cerebral palsy, adult brain injury and arthrogryposis.

[PMID: 24641744](#) [PubMed - in process]**3. Gait Posture. 2014 Feb 22. pii: S0966-6362(14)00062-9. doi: 10.1016/j.gaitpost.2014.02.006. [Epub ahead of print]****The Arm Posture Score for assessing arm swing during gait: An evaluation of adding rotational components and the effect of different gait speeds.**

Frykberg GE1, Johansson GM2, Schelin L2, Häger CK3.

In 3D gait analysis, quantification of leg movements is well established, whereas a measure of arm swing has been lacking. Recently, the Arm Posture Score (APS) was introduced to characterize arm movements in children with cerebral palsy, including information from four variables (APS4) in the sagittal and frontal planes. A potential limitation of the APS is that it does not include rotational movements and has not yet been evaluated with regard to gait speed. The aims of this study were (i) to investigate the effect on APS of adding two components of arm rotation (APS6) and (ii) to determine the influence of gait speed on the APS measures, when applied to non-disabled adults. Forty-two subjects walked 10m at a self-selected speed (1.34m/s), and in addition a subgroup of 28 subjects walked at a slow speed (0.66m/s) set by a metronome. Data were collected from markers in a whole-body set up and by eight optoelectronic cameras. The results demonstrated significantly higher APS6 than APS4 values for both arms, irrespective of gait speed. Speed condition, whether self-selected or slow, had a significant effect on both APS measures. The two additional arm components are suggested to provide relevant information about arm swing during walking. However, APS6 needs to be implemented in gait analysis of individuals with gait arm pathologies in order to further examine its utility. We recommend that gait speed should be taken into account when using APS measures to quantify arm swing during gait.

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[PMID: 24647039](#) [PubMed - as supplied by publisher]**4. Gait Posture. 2014 Feb 23. pii: S0966-6362(14)00064-2. doi: 10.1016/j.gaitpost.2014.01.024. [Epub ahead of print]****Which method of hip joint centre localisation should be used in gait analysis?**

Sangeux M1, Pillet H2, Skalli W2.

Accurate localisation of the hip joint centre is required to obtain accurate kinematics, kinetics and musculoskeletal

modelling results. Literature data showed that conclusions drawn from synthetic data, adult normal subjects and cerebral palsy children may vary markedly. This study investigated the localisation accuracy of the hip joint centre against EOS. The EOS system allowed us to register the hip joint centres with respect to the skin markers on standing subjects. A comprehensive set of predictive and functional calibration techniques were tested. For the functional calibration techniques, our results showed that algorithm, range of motion and self-performance of the movement were factors significantly affecting the results. Best results were obtained for comfortable range and self-performance of the movement. The best method in this scenario was the functional geometrical sphere fitting method which localised the hips 1.1cm from the EOS reference in average and 100% of the time within 3cm. Worst results for functional calibration methods occurred when the movement was assisted with a reduced range of movement. The best method in this scenario was the Harrington et al. regression equations since it does not rely on a functional calibration movement. Harrington et al. equations put the hips 1.7cm from the EOS reference in average and 97% of the time within 3cm. We conclude that accurate localisation of the hip joint centre is possible in gait analysis providing that method to localise the hip joint centres are adapted to the population studied: functional geometrical sphere fitting when hip calibration movements are not a problem and Harrington et al. predictive equations otherwise.

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[PMID: 24631279](#) [PubMed - as supplied by publisher]

**5. Res Dev Disabil. 2014 Mar 15. pii: S0891-4222(14)00051-1. doi: 10.1016/j.ridd.2014.02.001. [Epub ahead of print]**

**Effects of gastrocnemius fascia lengthening on gait pattern in children with cerebral palsy using the Gait Profile Score.**

Ferreira LA1, Cimolin V2, Costici PF3, Albertini G4, Oliveira CS5, Galli M6.

The aim of the present study was to investigate the efficacy of the GPS regarding the quantification of changes in gait following the gastrocnemius fascia lengthening in children with CP. Nineteen children with CP were selected and evaluated in the preoperative period (PRE session) and approximately one year postoperatively (POST session; mean 13.1±5.1 months) using 3D gait analysis and computing the GPS and GVSs. As the GPS represents the difference between the patient's data and the average from the reference dataset, the higher the value of GPS is, more compromised gait of the subject. A statistically significant improvement in mean GPS was found in the POST session (PRE: 13.38±5°; POST: 10.26±2.41°; p<0.05), with an improvement close to 23%. Moreover, the GVSs demonstrated statistically significant improvements in ankle dorsi-plantarflexion (PRE: 22.20±16.36°; POST: 11.50±6.57°; p<0.05) and pelvic rotation (PRE: 9.53±3.87°; POST: 6.47±2.98°; p<0.05). A strong correlation (r=0.75; p<0.05) was found between the preoperative GPS and the percentage of GPS improvement. The results demonstrated that the gastrocnemius fascia lengthening produced a global gait pattern improvement, as showed by the GPS value, which decreased after surgery. Besides this, the GVS permitted to better evidence the joints more compromised by the pathology and their improvement due to the surgery, in this case not only the GVS of the ankle joint but also of the pelvis were characterized by higher GVS values.

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[PMID: 24642227](#) [PubMed - as supplied by publisher]

**6. PLoS One. 2014 Mar 20;9(3):e91759. doi: 10.1371/journal.pone.0091759. eCollection 2014.**

**Muscle activation patterns when passively stretching spastic lower limb muscles of children with cerebral palsy.**

Bar-On L1, Aertbeliën E2, Molenaers G3, Desloovere K1.

The definition of spasticity as a velocity-dependent activation of the tonic stretch reflex during a stretch to a passive muscle is the most widely accepted. However, other mechanisms are also thought to contribute to pathological muscle activity and, in patients post-stroke and spinal cord injury can result in different activation patterns. In the lower-limbs of children with spastic cerebral palsy (CP) these distinct activation patterns have not yet been

thoroughly explored. The aim of the study was to apply an instrumented assessment to quantify different muscle activation patterns in four lower-limb muscles of children with CP. Fifty-four children with CP were included (males/females n=35/19; 10.8±3.8 yrs; bilateral/unilateral involvement n= 32/22; Gross Motor Functional Classification Score I-IV) of whom ten were retested to evaluate intra-rater reliability. With the subject relaxed, single-joint, sagittal-plane movements of the hip, knee, and ankle were performed to stretch the lower-limb muscles at three increasing velocities. Muscle activity and joint motion were synchronously recorded using inertial sensors and electromyography (EMG) from the adductors, medial hamstrings, rectus femoris, and gastrocnemius. Muscles were visually categorised into activation patterns using average, normalized root mean square EMG (RMS-EMG) compared across increasing position zones and velocities. Based on the visual categorisation, quantitative parameters were defined using stretch-reflex thresholds and normalized RMS-EMG. These parameters were compared between muscles with different activation patterns. All patterns were dominated by high velocity-dependent muscle activation, but in more than half, low velocity-dependent activation was also observed. Muscle activation patterns were found to be both muscle- and subject-specific (p<0.01). The intra-rater reliability of all quantitative parameters was moderate to good. Comparing RMS-EMG between incremental position zones during low velocity stretches was found to be the most sensitive in categorizing muscles into activation patterns (p<0.01). Future studies should investigate whether muscles with different patterns react differently to treatment.

[PMID: 24651860](#) [PubMed - in process]

**7. J Pediatr. 2014 Mar 12. pii: S0022-3476(14)00078-X. doi: 10.1016/j.jpeds.2014.01.050. [Epub ahead of print]**

#### **Botulinum Toxin A for Nonambulatory Children with Cerebral Palsy: A Double Blind Randomized Controlled Trial.**

Copeland L1, Edwards P2, Thorley M2, Donaghey S2, Gascoigne-Pees L2, Kentish M2, Cert G2, Lindsley J2, McLennan K2, Sakzewski L3, Boyd RN3.

**OBJECTIVES:** To examine the efficacy and safety of intramuscular botulinum toxin A (BoNT-A) to reduce spasticity and improve comfort and ease of care in nonambulant children with cerebral palsy (CP). **STUDY DESIGN:** Nonambulant children with CP (n = 41; Gross Motor Function Classification System level IV = 3, level V = 38; mean age 7.1 years, range 2.3-16 years, 66% male) were randomly allocated to receive either intramuscular BoNT-A injections (n = 23) or sham procedure (n = 18) combined with therapy. The analysis used generalized estimating equations with primary outcome the Canadian Occupational Performance Measure (COPM) at 4 weeks postintervention and retention of effects at 16 weeks. Adverse events (AE) were collected at 2, 4, and 16 weeks by a physician masked to group allocation. **RESULTS:** There were significant between group differences favoring the BoNT-A-treated group on COPM performance at 4 weeks (estimated mean difference 2.2, 95% CI 0.8, 3.5; P = .002) and for COPM satisfaction (estimated mean difference 2.2, 95% CI 0.5, 3.9; P = .01). These effects were retained at 16 weeks for COPM satisfaction (estimated mean difference 1.8, 95% CI 0.1, 3.5; P = .04). There were more mild AE at 4 weeks for the BoNT-A group (P = .002), however, there were no significant between-group differences in the reporting of moderate and serious AE. **CONCLUSIONS:** In a double-blind randomized sham-controlled trial, intramuscular BoNT-A and therapy were effective for improving ease of care and comfort for nonambulant children with CP. There was no increase in moderate and severe AE in the children who had BoNT-A injections compared with the sham group.

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[PMID: 24630348](#) [PubMed - as supplied by publisher]

**8. Arch Dis Child. 2014 Apr;99(4):392-4. doi: 10.1136/archdischild-2013-305805.**

#### **Question 2: Is there any long-term benefit from injecting botulinum toxin-A into children with cerebral palsy?**

Bradley LJ1, Huntley JS.

[PMID: 24626322](#) [PubMed - in process]

**9. J Phys Ther Sci. 2014 Feb;26(2):285-9. doi: 10.1589/jpts.26.285. Epub 2014 Feb 28.**

**Rehabilitation outcomes of children with cerebral palsy.**

Yalcinkaya EY1, Caglar NS1, Tugcu B2, Tonbaklar A3.

**Purpose:** To evaluate the results of Bobath-based rehabilitation performed at a pediatric cerebral palsy (CP) inpatient clinic. **Subjects and Methods:** The study subjects were 28 children with CP who were inpatients at a pediatric service. Inclusion criteria were: being an inpatient of our hospital aged 2-12 with a diagnosis of CP; having one permanent primary caregiver; and the caregiver having no medical or psychotic problems. All of the patients received Bobath treatment for 1 hour per day, 5 days a week. The locomotor system, neurologic and orthopedic examination, Gross Motor Function Measure (GMFM) of the patients, and Short Form-36 (SF-36) of permanent caregivers were evaluated at the time of admission to hospital, discharge from hospital, and at 1 and 3 months after discharge. **Results:** Post-admission scores of GMFM at discharge, and 1 and 3 months later showed significant increase. Social function and emotional role subscores of SF-36 had increased significantly at discharge. **Conclusion:** Bobath treatment is promising and randomized controlled further studies are needed for rehabilitation technics.

[PMID: 24648650](#) [PubMed]

**10. Res Dev Disabil. 2014 Mar 13. pii: S0891-4222(14)00039-0. doi: 10.1016/j.ridd.2014.01.025. [Epub ahead of print]**

**A clinical decision framework for the identification of main problems and treatment goals for ambulant children with bilateral spastic cerebral palsy.**

Franki I1, De Cat J2, Deschepper E3, Molenaers G4, Desloovere K2, Himpens E5, Vanderstraeten G5, Van den Broeck C5.

The primary aim of the study was to investigate how a clinical decision process based on the International Classification of Function, Disability and Health (ICF) and the Hypothesis-Oriented Algorithm for Clinicians (HOAC-II) can contribute to a reliable identification of main problems in ambulant children with cerebral palsy (CP). As a secondary aim, to evaluate how the additional information from three-dimensional gait analysis (3DGA) can influence the reliability. Twenty-two physical therapists individually defined the main problems and specific goals of eight children with bilateral spastic CP. In four children, the results of 3DGA were provided additionally to the results of the clinical examination and the GMFM-88 (gross motor function measure-88). Frequency analysis was used to evaluate the selected main problems and goals. For the main problems, pair-wise agreement was calculated by the number of corresponding problems between the different therapists and using positive and negative agreement per problem. Cluster analysis using Ward's method was used to evaluate correspondence between the main problems and specific goals. The pair-wise agreement revealed frequencies of 47%, 32% and 3% for the identification of one, two or three corresponding main problems. The number of corresponding main problems was higher when additional information of 3DGA was provided. Most of the specific goals were targeting strength (34%), followed by range of motion (15.2%) and GMFM-D (11.8%). In 29.7% of the cases, therapists could not prioritize and exceeded the number of eight specific goals. Cluster analysis revealed a logic connection between the selection of strength as a main problem and as specific goal parameters. Alignment as a main problem was very often associated with specific parameters like ROM and muscle length and with hypertonia as a main problem. The results show a moderate agreement for the selection of main problems. Therapists are able to use the proposed model for a logic and structured clinical reasoning. Setting priorities in the definition of specific goals is revealed as a remaining difficulty. Further research is required to investigate the additional value of 3DGA and to improve priority setting.

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[PMID: 24631275](#) [PubMed - as supplied by publisher]

**11. Phys Ther. 2014 Mar 20. [Epub ahead of print]****Youth With Cerebral Palsy Compared With Age-, Sex-, and Season-Matched Youth Who Are Developing Typically: An Explorative Study.**

Obeid J1, Balemans AC, Noorduyn SG, Gorter JW, Timmons BW.

**BACKGROUND:** Children with cerebral palsy (CP) demonstrate reduced physical activity levels when compared with their typically developing peers. Sedentary behavior, including the duration and frequency of sedentary bouts, has not yet been objectively examined in this population but may have clinical implications for the development of secondary health complications. **OBJECTIVE:** To identify time spent sedentary and frequency of breaks interrupting sedentary time in youth with CP compared with youth without CP. It was hypothesized that individuals with CP would spend more hours sedentary than their peers and show fewer breaks to interrupt sedentary time. **DESIGN:** Cross-sectional, prospective study. **METHODS:** A convenience sample of 17 ambulatory children with CP (15 males), mean (SD) age of 13.0 (2.2) years, and 17 age-, sex-, and season-matched typically developing youth (TD, age: 12.9 (2.5) years) wore an accelerometer over a 7-day period. Sedentary time (min) and breaks (#) from sedentary time, corrected for monitoring and sedentary time, respectively, were examined. Differences between groups were determined with an independent samples t-test ( $p < 0.05$ ). **RESULTS:** Children with CP engaged in significantly more sedentary time (47.5 (4.9) vs TD 43.6 (4.2) min/h,  $p = 0.017$ ), with significantly fewer breaks from sedentary time (179 (70) vs TD 232 (61) breaks/h sedentary,  $p = 0.025$ ). **LIMITATIONS:** The sample only includes ambulatory youth with CP, classified as GMFCS levels I-III. **CONCLUSIONS:** Sedentary time is higher in children with CP and is characterized by less frequent breaks when compared with their typically developing peers. Future research should examine the extent to which sedentary time is associated with cardiovascular and metabolic risk in youth with CP.

[PMID: 24652472](#) [PubMed - as supplied by publisher]

**12. Physiother Res Int. 2014 Mar 14. doi: 10.1002/pri.1584. [Epub ahead of print]****Measuring Physical Activity in Young People with Cerebral Palsy: Validity and Reliability of the ActivPAL™ Monitor.**

Bania T.

**BACKGROUND AND PURPOSE:** We determined the criterion validity and the retest reliability of the ActivPAL™ monitor in young people with diplegic cerebral palsy (CP). **METHODS:** Activity monitor data were compared with the criterion of video recording for 10 participants. For the retest reliability, activity monitor data were collected from 24 participants on two occasions. Participants had to have diplegic CP and be between 14 and 22 years of age. They also had to be of Gross Motor Function Classification System level II or III. Outcomes were time spent in standing, number of steps (physical activity) and time spent in sitting (sedentary behaviour). **RESULTS:** For criterion validity, coefficients of determination were all high ( $r^2 \geq 0.96$ ), and limits of group agreement were relatively narrow, but limits of agreement for individuals were narrow only for number of steps ( $\geq 5.5\%$ ). Relative reliability was high for number of steps (intraclass correlation coefficient = 0.87) and moderate for time spent in sitting and lying, and time spent in standing (intraclass correlation coefficients = 0.60-0.66). For groups, changes of up to 7% could be due to measurement error with 95% confidence, but for individuals, changes as high as 68% could be due to measurement error. **DISCUSSION:** The results support the criterion validity and the retest reliability of the ActivPAL™ to measure physical activity and sedentary behaviour in groups of young people with diplegic CP but not in individuals.

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[PMID: 24634324](#) [PubMed - as supplied by publisher]

**13. Dev Med Child Neurol. 2014 Mar 20. doi: 10.1111/dmcn.12424. [Epub ahead of print]****Sedentary behaviour in adolescents and young adults with cerebral palsy.**

Taylor NF.

[PMID: 24645741](#) [PubMed - as supplied by publisher]

**14. Dev Med Child Neurol. 2014 Mar 19. doi: 10.1111/dmcn.12441. [Epub ahead of print]**

**Sleep, the other life of children with cerebral palsy.**

Newman CJ.

[PMID: 24641776](#) [PubMed - as supplied by publisher]

**15. J Child Psychol Psychiatry. 2014 Mar 17. doi: 10.1111/jcpp.12227. [Epub ahead of print]**

**Improving child and parenting outcomes following paediatric acquired brain injury: a randomised controlled trial of Stepping Stones Triple P plus Acceptance and Commitment Therapy.**

Brown FL1, Whittingham K, Boyd RN, McKinlay L, Sofronoff K.

**BACKGROUND:** Persistent behavioural difficulties are common following paediatric acquired brain injury (ABI). Parents and families also experience heightened stress, psychological symptoms and burden, and there is evidence of a reciprocal relationship between parent and child functioning, which may be mediated by the adoption of maladaptive parenting practices. Despite this, there is currently a paucity of research in family interventions in this population. The aim of this study was to determine the efficacy of Stepping Stones Triple P: Positive Parenting Program (SSTP), with an Acceptance and Commitment Therapy (ACT) workshop, in improving child outcomes and parenting practices following paediatric ABI. **METHODS:** Fifty-nine parents of children (mean age 7 years, SD 3 years, 1 month; 35 males, 24 females) with ABI (Traumatic injuries 58%, Tumour 17%, Encephalitis or meningitis 15%, Cardiovascular accident 7%, Hypoxia 3%) who were evidencing at least mild behaviour problems were randomly assigned to treatment or care-as-usual conditions over 10 weeks. Mixed-model repeated-measures linear regression analyses were conducted to compare conditions from pre- to postintervention on child behavioural and emotional functioning (Eyberg Child Behavior Inventory, Strengths and Difficulties Questionnaire) and dysfunctional parenting style (Parenting Scale). Assessment of maintenance of change was conducted at a 6-month follow-up. The trial was registered on Australian New Zealand Clinical Trials Registry (ID: ACTRN12610001051033, [www.anzctr.org.au](http://www.anzctr.org.au)). **RESULTS:** Significant time-by-condition interactions were identified on number and intensity of child behaviour problems, child emotional symptoms and parenting laxness and overreactivity, indicating significant improvements in the treatment condition, with medium-to-large effect sizes. Most improvements were maintained at 6 months. **CONCLUSIONS:** Group parenting interventions incorporating Triple P and ACT may be efficacious in improving child and parenting outcomes following paediatric ABI.

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[PMID: 24635872](#) [PubMed - as supplied by publisher]

**16. Dev Med Child Neurol. 2014 Mar 19. doi: 10.1111/dmcn.12435. [Epub ahead of print]**

**Stability of motor function and associated impairments between childhood and adolescence in young people with cerebral palsy in Europe.**

Nystrand M1, Beckung E, Dickinson H, Colver A.

**AIM:** The aim of the study was to investigate whether impairments associated with cerebral palsy were stable between childhood and adolescence. **METHOD:** The Study of Participation of Children with Cerebral Palsy Living in Europe (SPARCLE) longitudinal study was conducted in nine European regions. In total, 818 children aged 8 to 12 years were randomly selected from population-based registers; 594 (73%) were followed up at the age of 13 to 17 years (344 males, 250 females; median age 10y 4mo) Research associates visited them in their homes and recorded their motor function and additional impairments. Stability of impairment was assessed using the weighted kappa coefficient. **RESULTS:** The proportion of participants whose level of impairment remained unchanged varied

from 63% for fine motor function to 98% for hearing. For gross motor function, communication, and cognitive level, the kappa and the lower bound of its 95% confidence interval (CI) were above 0.75, indicating stability between childhood and adolescence; for fine motor function and feeding, the kappa was above 0.75 but the lower bound of the 95% CI was below 0.75, indicating probable stability; for seizures and vision, the kappa was below 0.75, although the upper bound of the 95% CI was above 0.75, indicating possible change; for hearing the kappa and its entire CI were below 0.75, indicating change. Overall, 81% of participants had no seizures in childhood, of whom 93% were seizure-free in adolescence. INTERPRETATION: Motor function and additional impairments were generally stable between childhood and adolescence.

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## 17. Pediatrics. 2014 Mar 17. [Epub ahead of print]

### PDA Ligation and Health Outcomes: A Meta-analysis.

Weisz DE1, More K, McNamara PJ, Shah PS.

**BACKGROUND AND OBJECTIVE** Patent ductus arteriosus (PDA) ligation has been variably associated with neonatal morbidities and neurodevelopmental impairment (NDI). The objective was to systematically review and meta-analyze the impact of PDA ligation in preterm infants at <32 weeks' gestation on the risk of mortality, severe neonatal morbidities, and NDI in early childhood. **METHODS:** Medline, Embase, Cochrane Central Register of Controlled Trials, Education Resources Information Centre (ERIC), Cumulative Index to Nursing and Allied Health (CINAHL), PsycINFO, and the Dissertation database were searched (1947 through August 2013). Risk of bias was assessed by using the Newcastle-Ottawa Scale and the Cochrane Risk of Bias tool. Meta-analyses were performed by using a random-effects model. Unadjusted and adjusted odds ratios (aORs) with 95% confidence intervals (CIs) were pooled when appropriate. **RESULTS:** Thirty-nine cohort studies and 1 randomized controlled trial were included. Nearly all cohort studies had at least moderate risk of bias mainly due to failure to adjust for survival bias and important postnatal preligation confounders such as ventilator dependence, intraventricular hemorrhage, and sepsis. Compared with medical treatment, surgical ligation was associated with increases in NDI (aOR: 1.54; 95% CI: 1.01-2.33), chronic lung disease (aOR: 2.51; 95% CI: 1.98-3.18), and severe retinopathy of prematurity (aOR: 2.23; 95% CI: 1.62-3.08) but with a reduction in mortality (aOR: 0.54; 95% CI: 0.38-0.77). There was no difference in the composite outcome of death or NDI in early childhood (aOR: 0.95; 95% CI: 0.58-1.57). **CONCLUSIONS:** Surgical ligation of PDA is associated with reduced mortality, but surviving infants are at increased risk of NDI. However, there is a lack of studies addressing survival bias and confounding by indication.

[PMID: 24639268](#) [PubMed - as supplied by publisher]

## 18. Cytotherapy. 2014 Mar 15. pii: S1465-3249(14)00029-2. doi: 10.1016/j.jcyt.2014.01.008. [Epub ahead of print]

### Safety and tolerability of intrathecal delivery of autologous bone marrow nucleated cells in children with cerebral palsy: an open-label phase I trial.

Mancías-Guerra C1, Marroquín-Escamilla AR2, González-Llano O3, Villarreal-Martínez L3, Jaime-Pérez JC3, García-Rodríguez F3, Valdés-Burnes SL3, Rodríguez-Romo LN3, Barrera-Morales DC3, Sánchez-Hernández JJ4, Cantú-Rodríguez OG3, Gutiérrez-Aguirre CH3, Gómez-De León A3, Elizondo-Riojas G5, Salazar-Riojas R3, Gómez-Almaguer D3.

**BACKGROUND AIMS:** Cerebral palsy (CP) is related to severe perinatal hypoxia with permanent brain damage in nearly 50% of surviving preterm infants. Cell therapy is a potential therapeutic option for CP by several mechanisms, including immunomodulation through cytokine and growth factor secretion. **METHODS:** In this phase I open-label clinical trial, 18 pediatric patients with CP were included to assess the safety of autologous bone marrow-derived total nucleated cell (TNC) intrathecal and intravenous injection after stimulation with granulocyte colony-stimulating factor. Motor, cognitive, communication, personal-social and adaptive areas were evaluated at baseline and 1 and 6 months after the procedure through the use of the Battelle Developmental Inventory. Magnetic resonance imaging was performed at baseline and 6 months after therapy. This study was registered in

ClinicalTrials.gov (NCT01019733). RESULTS: A median of  $13.12 \times 10^8$  TNCs (range, 4.83-53.87) including  $10.02 \times 10^6$  CD34+ cells (range, 1.02-29.9) in a volume of 7 mL (range, 4-10.5) was infused intrathecally. The remaining cells from the bone marrow aspirate were administered intravenously;  $6.01 \times 10^8$  TNCs (range, 1.36-17.85), with  $3.39 \times 10^6$  cells being CD34+. Early adverse effects included headache, vomiting, fever and stiff neck occurred in three patients. No serious complications were documented. An overall 4.7-month increase in developmental age according to the Battelle Developmental Inventory, including all areas of evaluation, was observed ( $\pm$ SD 2.63). No MRI changes at 6 months of follow-up were found. CONCLUSIONS: Subarachnoid placement of autologous bone marrow-derived TNC in children with CP is a safe procedure. The results suggest a possible increase in neurological function.

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[PMID: 24642016](#) [PubMed - as supplied by publisher]

**19. Dev Med Child Neurol. 2014 Mar 18. doi: 10.1111/dmcn.12433. [Epub ahead of print]**

**Making it possible - interventions for children with cerebral palsy.**

Beckung E.

[PMID: 24635881](#) [PubMed - as supplied by publisher]

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Rutz E1, Döderlein L, Svehlik M, Vavken P, Gaston MS.

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**Researching conductive education.**

Schenker R1, Sutton A.

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## Prevention and Cure

**33. Ann Neurol. 2014 Feb 6. doi: 10.1002/ana.24115. [Epub ahead of print]**

**Unmyelinated axon loss with postnatal hypertonia after fetal hypoxia.**

Drobyshevsky A1, Jiang R, Lin L, Derrick M, Luo K, Back SA, Tan S.

**OBJECTIVE:** White matter (WM) injury due to myelination defects is believed to be responsible for the motor deficits seen in cerebral palsy. We tested the hypothesis that the predominant injury is to functional electrical connectivity in unmyelinated WM fibers by conducting a longitudinal study of central WM tracts in newborn rabbit kits with hypertonia in our model of cerebral palsy. **METHODS:** Pregnant rabbits at 70% gestation underwent 40-minute uterine ischemia. Motor deficits in newborn kits, including muscle hypertonia, were assessed by neurobehavioral testing. Major central WM tracts, including internal capsule, corpus callosum, anterior commissure, and fimbria hippocampi, were investigated for structural and functional injury using diffusion tensor magnetic resonance imaging (MRI), electrophysiological recordings of fiber conductivity in perfused brain slices, electron microscopy, and immunohistochemistry of oligodendrocyte lineage. **RESULTS:** Motor deficits were observed on postnatal day 1 (P1) when WM tracts were unmyelinated. Myelination occurred later and was obvious by P18. Hypertonia was associated with microstructural WM injury and unmyelinated axon loss at P1, diagnosed by diffusion tensor MRI and electron microscopy. Axonal conductivity from electrophysiological recordings in hypertonic P18 kits decreased only in unmyelinated fibers, despite a loss in both myelinated and unmyelinated axons. **INTERPRETATION:** Motor deficits in cerebral palsy were associated with loss of unmyelinated WM tracts. The contribution of injury to myelinated fibers that was observed at P18 is probably a secondary etiological factor in the motor and sensory deficits in the rabbit model of cerebral palsy. *Ann Neurol* 2014.

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**34. An Pediatr (Barc). 2014 Mar 10. pii: S1695-4033(14)00023-X. doi: 10.1016/j.anpedi.2013.12.016. [Epub ahead of print]**

**Incidence of cerebral palsy in a cohort of preterm infants with a gestational age of less than 28 weeks [Article in Spanish]**

Agut T1, Póo P2, Launes C3, Auffant M2, Iriondo M3.

[PMID: 24635975](#) [PubMed - as supplied by publisher] Free full text

**35. Ann Rehabil Med. 2014 Feb;38(1):138-43. doi: 10.5535/arm.2014.38.1.138. Epub 2014 Feb 25.**

**Clinical features and associated abnormalities in children and adolescents with corpus callosal anomalies.**

Kim YU, Park ES, Jung S, Suh M, Choi HS, Rha DW.

Callosal anomalies are frequently associated with other central nervous system (CNS) and/or somatic anomalies. We retrospectively analyzed the clinical features of corpus callosal agenesis/hypoplasia accompanying other CNS and/or somatic anomalies. We reviewed the imaging and clinical information of patients who underwent brain magnetic resonance imaging in our hospital, between 2005 and 2012. Callosal anomalies were isolated in 13 patients, accompanied by other CNS anomalies in 10 patients, associated with only non-CNS somatic anomalies in four patients, and with both CNS and non-CNS abnormalities in four patients. Out of 31 patients, four developed normally, without impairments in motor or cognitive functions. Five of nine patients with cerebral palsy were accompanied by other CNS and/or somatic anomalies, and showed worse Gross Motor Function Classification System scores, compared with the other four patients with isolated callosal anomaly. In addition, patients with other CNS anomalies also had a higher seizure risk.

[PMID: 24639939](#) [PubMed] PMCID: PMC3953358 Free PMC Article

**36. Arch Gynecol Obstet. 2014 Mar 19. [Epub ahead of print]**

**Pathology of perinatal brain damage: background and oxidative stress markers.**

Tonni G1, Leoncini S, Signorini C, Ciccoli L, De Felice C.

**PURPOSE:** To review historical scientific background and new perspective on the pathology of perinatal brain damage. The relationship between birth asphyxia and subsequent cerebral palsy has been extensively investigated. The role of new and promising clinical markers of oxidative stress (OS) is presented. **METHODS:** Electronic search of PubMed-Medline/EMBASE database has been performed. Laboratory and clinical data involving case series from the research group are reported. **RESULTS:** The neuropathology of birth asphyxia and subsequent perinatal brain damage as well as the role of electronic fetal monitoring are reported following a review of the medical literature. **CONCLUSIONS:** This review focuses on OS mechanisms underlying the neonatal brain damage and provides different perspective on the most reliable OS markers during the perinatal period. In particular, prior research work on neurodevelopmental diseases, such as Rett syndrome, suggests the measurement of oxidized fatty acid molecules (i.e., F4-Neuroprostanes and F2-Dihomo-Isoprostanes) closely related to brain white and gray matter oxidative damage.

[PMID: 24643805](#) [PubMed - as supplied by publisher]

**37. BJOG. 2014 Apr;121(5):647. doi: 10.1111/1471-0528.12751.**

**A report from #BlueJC: are we convinced antenatal magnesium sulphate can prevent cerebral palsy in preterm infants?**

[No authors listed]

[PMID: 24636319](#) [PubMed - in process]

**38. J Child Neurol. 2014 Mar 18. [Epub ahead of print]****Systemic Inflammation and Cerebral Palsy Risk in Extremely Preterm Infants.**

Kuban KC1, O'Shea TM, Allred EN, Paneth N, Hirtz D, Fichorova RN, Leviton A; for the ELGAN Study Investigators.

The authors hypothesized that among extremely preterm infants, elevated concentrations of inflammation-related proteins in neonatal blood are associated with cerebral palsy at 24 months. In 939 infants born before 28 weeks gestation, the authors measured blood concentrations of 25 proteins on postnatal days 1, 7, and 14 and evaluated associations between elevated protein concentrations and cerebral palsy diagnosis. Protein elevations within 3 days of birth were not associated with cerebral palsy. Elevations of tumor necrosis factor- $\alpha$ , tumor necrosis factor- $\alpha$ -receptor-1, interleukin-8, and intercellular adhesion molecule-1 on at least 2 days were associated with diparesis. Recurrent-persistent elevations of interleukin-6, E-selectin, or insulin-like growth factor binding protein-1 were associated with hemiparesis. Diparesis and hemiparesis were more likely among infants who had at least 4 of 9 protein elevations that previously have been associated with cognitive impairment and microcephaly. Repeated elevations of inflammation-related proteins during the first 2 postnatal weeks are associated with increased risk of cerebral palsy.

[PMID: 24646503](#) [PubMed - as supplied by publisher]

**39. J Clin Neurosci. 2014 Feb 6. pii: S0967-5868(14)00046-0. doi: 10.1016/j.jocn.2013.10.040. [Epub ahead of print]****Neuroprotection with erythropoietin in preterm and/or low birth weight infants.**

Zhang J1, Wang Q1, Xiang H1, Xin Y1, Chang M1, Lu H2.

Neonatal brain injury caused by extreme prematurity remains a great challenge for prevention. Erythropoietin (EPO) has shown neuroprotective effects in a series of neonatal experimental models and recent clinical trials of premature infants. In this meta-analysis of seven clinical trials, EPO was associated with a highly reproducible reduction in the risk of neurodevelopmental disability in preterm infants. However, there was no difference in the risk for morbidity, cerebral palsy, visual deficit, severe hearing deficit, necrotizing enterocolitis, intracranial hemorrhage and patent ductus arteriosus. The use of EPO, to some extent, is associated with reduction in neurodevelopmental disability in preterm infants. More double blind randomized controlled trials are needed to establish the best therapeutic approach for neuroprotection in preterm infants.

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[PMID: 24650681](#) [PubMed - as supplied by publisher]

**40. Rev Med Suisse. 2014 Feb 19;10(418):450-3.****Neurodevelopmental outcome of very premature infants [Article in French]**

Graz MB, Newman CJ, Borradori-Tolsa C.

Very preterm infants are at risk of neurodevelopmental impairments, which may affect motor development, intelligence and behavior. Neurodevelopmental follow-up is offered to these children who represent 1% of Swiss births, and may show abnormal motor tone, which sometimes resolves spontaneously or evolves in cerebral palsy. Standardized tests explore intellectual functioning and may allow the diagnosis of specific learning impediments. Finally, behavior is assessed with standardized questionnaires which can reveal hyperactivity with or without attention deficit, impaired social relations, psychiatric troubles or autism, all more frequent amongst preterm children.

[PMID: 24640281](#) [PubMed - in process]