

Monday 8 July 2019

**Cerebral Palsy Alliance** is delighted to bring you this free weekly bulletin of the latest published research into cerebral palsy. Our organisation is committed to supporting cerebral palsy research worldwide - through information, education, collaboration and funding. Find out more at [cerebralpalsy.org.au/our-research](http://cerebralpalsy.org.au/our-research)

**Professor Nadia Badawi AM**

Macquarie Group Foundation Chair of Cerebral Palsy

[Subscribe to CP Research News](#)

## Interventions and Management

### 1. The Mechanism of Hip Dislocation related to the Use of Abduction Bar and Hip Compression Bandage in Patients with Spastic Cerebral Palsy.

Kim S, Lee D, Ko JY, Park Y, Yoon YH, Suh JH, Ryu JS.

Am J Phys Med Rehabil. 2019 Jul 1. doi: 10.1097/PHM.0000000000001261. [Epub ahead of print]

**OBJECTIVE:** To identify the differences of forces in the hip adductors between with or without the abduction bar (AB) and evaluate the effect of hip compression bandage on the spasticity of the adductor muscles. **DESIGN:** Thirty-three patients with cerebral palsy (Gross Motor Functional Classification System (GMFCS) IV and V) were prospectively included. Surface electromyography (S-EMG) was taken by attaching EMG on the adductor and abductor muscles. Theraband was used as hip compression bandage. S-EMG were taken when spasticity provoked with and without AB, as well as with both AB and hip compression bandage. Root mean square (RMS) values were measured. **RESULTS:** RMS values were significantly increased with AB in the adductor longus, adductor magnus, and tensor fascia lata muscles. Adductor Sum and Net Adduction Index showed significant increases after the use of AB. After applying hip compression bandage, the NET Adduction Index was significantly decreased. **CONCLUSION:** Our results showed significant changes in the adductor muscles' amplitude, Adduction Sum, and Net Adduction Index. These results indicate that forces which worsen hip dislocation may develop, and therefore, AB should either not be used for spastic CP patients or should only be used with hip compression wrapping in place as well.

PMID: [31268886](#)

### 2. Hip Adductor Intramuscular Nerve Distribution Pattern of Children: A Guide for BTX-A Treatment to Muscle Spasticity in Cerebral Palsy.

Yan Y, Fu X, Xie X, Ji S, Luo H, Yang F, Zhang X, Yang S, Xie P.

Front Neurol. 2019 Jun 14;10:616. doi: 10.3389/fneur.2019.00616. eCollection 2019.

To investigate the intramuscular nerve distribution pattern in the hip adductors of children and to precisely locate the injection site for botulinum toxin type A (BTX-A) as a treatment for hip adductor spasticity in children with cerebral palsy. Modified Sihler's whole mount nerve staining technique was employed to observe the distribution of intramuscular nerves in hip adductors of children and to further locate zones where terminal nerves are concentrated. The terminal nerves of the adductor longus appeared in a longitudinal distribution band parallel to the line between the upper 1/3 point of the lateral boundary and the center of the medial boundary. In adductor brevis, the terminal nerves showed a sheet-like distribution with a nerve dense area located in the middle of the muscle belly that extends from the upper-inner region to the lower-outer region. Gracilis showed a dense area of terminal nerves in the middle of the muscle belly, closer to the posterior boundary. In adductor magnus, the dense area of terminal nerves showed a sheet-like distribution in the middle and lower region of the muscle belly.

The dense area of terminal nerves in the pectineus was located in the middle of the muscle belly. This study is the first to systematically investigate the intramuscular nerve distribution pattern in the hip adductors. The results indicated that the best targets for BTX-A injection, when treating spasticity, are the dense regions of terminal nerves described above.

PMID: [31258508](#)

### **3. Botulinum Toxin in the Management of Children with Cerebral Palsy.**

Multani I, Manji J, Hastings-Ison T, Khot A, Graham K.

Paediatr Drugs. 2019 Jul 1. doi: 10.1007/s40272-019-00344-8. [Epub ahead of print]

During the past 25 years, botulinum toxin type A (BoNT-A) has become the most widely used medical intervention in children with cerebral palsy. In this review we consider the gaps in our knowledge in the use of BoNT-A and reasons why muscle morphology and function in children with cerebral palsy are impaired. We review limitations in our knowledge regarding the mechanisms underlying the development of contractures and the difficulty in preventing them. It is clear from this review that injection of BoNT-A in the large muscles of both the upper and lower limbs of children with cerebral palsy will result in a predictable decrease in muscle activity, which is usually reported as a reduction in spasticity, for between 3 and 6 months. These changes are noted by the use of clinical tools such as the Modified Ashworth Scale and the Modified Tardieu Scale. Decreased muscle over-activity usually results in improved range of motion in distal joints. Injection of the gastrocnemius muscle for toe-walking in a child with hemiplegia or diplegia usually has the effect of increasing the passive range of dorsiflexion at the ankle. In our review, we found that this may result in a measurable improvement in gait by the use of observational gait scales or gait analysis, in some children. However, improvements in gait function are not always achieved and are small in magnitude and short lived. We found that some of the differences in outcomes in clinical trials may relate to the use of adjunctive interventions such as serial casting, orthoses, night splints and intensive therapy. We note that the majority of clinical trials of the use of BoNT-A in children with cerebral palsy have focussed on a single injection cycle and this is insufficient to understand the balance between benefit and harm. Most outcomes were reported in terms of changes in muscle tone and there were fewer studies with robust methodology that reported improvements in function. Changes in the domains of activities and participation have rarely been reported in studies to date. There were no clinical reviews to date that consider the findings of studies in human volunteers and in experimental animals and their relevance to clinical protocols. In this review we found that studies in human volunteers and in experimental animals show muscle atrophy after an injection of BoNT-A for at least 12 months. Muscle atrophy was accompanied by loss of contractile elements in muscle and replacement with fat and connective tissue. It is not currently known if these changes, mediated at a molecular level, are reversible. We conclude that there is a need to revise clinical protocols by using BoNT-A more thoughtfully, less frequently and with greatly enhanced monitoring of the effects on injected muscle for both short-term and long-term benefits and harms.

PMID: [31257556](#)

### **4. Perceived body distortion rather than actual body distortion is associated with chronic low back pain in adults with cerebral palsy: A preliminary investigation.**

Yamashita H, Nishigami T, Mibu A, Tanaka K, Manfuku M, Fukuhara H, Yoshino K, Seto Y, Wand BM.

Pain Pract. 2019 Jul 2. doi: 10.1111/papr.12815. [Epub ahead of print]

**OBJECTIVES:** The aim of the present study was to investigate whether distorted body perception is a feature of the low back pain experience in people with Cerebral Palsy (CP) and whether any distortions noted are confounded by the presence of motor and postural impairments commonly seen in CP. **METHODS:** Forty-five individuals participated in this study: fifteen adults with CP with LBP (CP\_Pain group), fifteen adults with CP without LBP (CP\_noPain group), and fifteen age-matched adults with LBP but no CP (Pain group). Body perception was evaluated using the Fremantle Back Awareness Questionnaire (FreBAQ) and by assessing two-point discrimination (TPD) thresholds over the low back. A comprehensive assessment of motor function was also undertaken in the CP population and postural function was assessed in all three groups. **RESULTS:** Significant differences between the three groups were found for FreBAQ scores ( $p < 0.0001$ ). The TPD threshold in the low back of the CP\_Pain group was significantly larger than that of the CP\_noPain group ( $p = 0.01$ ), though we found no difference between the CP\_noPain group and the Pain group ( $p = 0.21$ ). We found no difference in motor or postural function between the two CP groups. **DISCUSSION:** The present results suggest that body image is disrupted in people with CP who experience low back pain. The disruptions in perception were similar to those seen in people with LBP and no CP suggesting the distortions maybe more related to the presence of pain than the presence of CP. This article is protected by copyright. All rights reserved.

PMID: [31264357](#)

### 5. Ankle foot orthoses for young children with cerebral palsy: a scoping review.

Firouzeh P, Sonnenberg LK, Morris C, Pritchard-Wiart L.

Disabil Rehabil. 2019 Jun 28;1-13. doi: 10.1080/09638288.2019.1631394. [Epub ahead of print]

**Aim:** To describe research on outcomes associated with early Ankle Foot Orthosis (AFO) use, AFO use patterns, and parent and clinician perspectives on AFO use among young children with cerebral palsy. **Method:** Arksey and O'Malley's five-stage method was used to conduct a scoping review. MEDLINE (Ovid), PubMed, CINAHL, Cochrane Database of Systematic Reviews, EMBASE, PEDro, Web of Science and Scopus were searched for studies evaluating AFO use with children under the age of six years. Descriptive information was extracted and outcomes categorized according to the International Classification of Functioning, Disability and Health (ICF). Quality assessments were conducted to evaluate methodological rigor. **Results:** Nineteen articles were included in the review; 14 focused on body functions and structures, seven on activity level outcomes and no studies addressed participation outcomes. Evaluations of the effects of AFOs on gross motor skills other than gait were limited. Overall, the body of evidence is comprised of methodologically weak studies with common threats to validity including inadequate descriptions of study protocols, AFO construction, and comparison interventions. **Conclusion:** Research evaluating the effects of AFOs on age-appropriate, functional outcomes including transitional movements, floor mobility and participation in early childhood settings is needed to inform practice regarding early orthotic prescription. Implications for rehabilitation Lack of rigorous evidence about the effects of AFOs in young children limits the ability of research to guide practice in pediatric rehabilitation. More rigorous research that evaluates a broader range of age-appropriate outcomes, including those focused on participation in meaningful activities, could further inform clinical practice. While clinicians often discuss expectations and goals with individual families, qualitative research that provides more insight into the experiences of families could guide AFO prescription and monitoring practices.

PMID: [31248284](#)

### 6. Muscle architecture in children with cerebral palsy and ankle contractures: an investigation using diffusion tensor imaging.

D'Souza A, Bolsterlee B, Lancaster A, Herbert RD.

Clin Biomech (Bristol, Avon). 2019 Jun 15;68:205-211. doi: 10.1016/j.clinbiomech.2019.06.013. [Epub ahead of print]

**BACKGROUND:** Children with cerebral palsy frequently have ankle contractures which may be caused by changes in architecture of calf muscles. Here, we compared the architecture of medial gastrocnemius muscles in children with unilateral cerebral palsy and typically developing children using novel imaging techniques. **METHODS AND PROCEDURES:** Muscle volumes, fascicle lengths, pennation angles and physiological cross-sectional areas were measured from diffusion tensor images and mDixon scans obtained from 20 ambulant children with unilateral spastic cerebral palsy who had ankle contractures (age  $11 \pm 3$  years; mean  $\pm$  standard deviation) and 20 typically developing children ( $11 \pm 4$  years). **FINDINGS:** In children with cerebral palsy, the more-affected side had, on average,  $13^\circ$  less dorsiflexion range and the medial gastrocnemius muscle had 4.9 mm shorter fascicles, 50 cm<sup>3</sup> smaller volume and 9.5 cm<sup>2</sup> smaller physiological cross-sectional area than the less-affected side. Compared to typically developing children, the more-affected side had  $10^\circ$  less dorsiflexion range and the medial gastrocnemius muscle had 4.2 mm shorter fascicles, 51 cm<sup>3</sup> smaller volume and 10 cm<sup>2</sup> smaller physiological cross-sectional area. We did not detect differences between the less-affected and typically developing legs. **INTERPRETATION:** Three-dimensional measurement of whole medial gastrocnemius muscles confirmed that the architecture of muscles on the more-affected side of children with cerebral palsy differs from the less-affected side and from muscles of typically developing children. Reductions in fascicle length, muscle volume and physiological cross-sectional area may contribute to muscle contracture.

PMID: [31255994](#)

### 7. The Cole Midfoot Osteotomy: Clinical and Radiographic Retrospective Review of Five Patients (Six Feet) with Different Etiologies.

Ergun S, Yildirim Y.

J Am Podiatr Med Assoc. 2019 May;109(3):180-186. doi: 10.7547/17-056.

**BACKGROUND:** Cole osteotomy is performed in patients having a cavus deformity with the apex of the deformity in the midfoot. Correction of the deformity at this midfoot level improves foot and ankle stability by creating a plantigrade foot. We

retrospectively reviewed the clinical and radiographic results of six feet (five patients) that underwent Cole midfoot osteotomy (2011-2015). **METHODS:** The patients had different etiologies (spastic cerebral palsy, burn sequelae, spina bifida, and Charcot-Marie-Tooth disease). Dorsal and slightly laterally based transverse wedge osteotomy through the navicular bone medially and the cuboid bone laterally was performed. Patients were under routine clinical follow-up. We evaluated clinical and radiographic results. **RESULTS:** Mean clinical follow-up was 15.7 months (range, 6-36 months). The mean preoperative and postoperative talo-first metatarsal angles on lateral radiographs were 29.9° and 8.7°, respectively ( $P < .05$ ) and on anteroposterior radiographs were 30.3° and 8.6° ( $P < .05$ ). The mean preoperative talocalcaneal angle on anteroposterior radiographs increased from 19.2° to 29.8° postoperatively ( $P < .05$ ). The mean postoperative calcaneal pitch angle change was 10.8° on the lateral radiograph ( $P < .05$ ). At final follow-up, all five patients were independently active, had plantigrade feet, and were able to wear conventional shoes. The mean American Orthopaedic Foot and Ankle Society questionnaire score was 38.8 preoperatively and 79.5 postoperatively ( $P < .05$ ). Only one patient did not have full bony union. Achilles tightness was seen in one patient. **CONCLUSIONS:** Cole midfoot osteotomy is a laboring procedure to correct adult pes cavus deformity with the apex in midfoot, although having some complication risks.

PMID: [31268782](#)

### **8. Effect of assisted walking-movement in patients with genetic and acquired neuromuscular disorders with the motorised Innowalk device: an international case study meta-analysis.**

Schmidt-Lucke C, Käferle J, Rydh Berner BM, Ahlborg L, Hansen HM, Skjellvik Tollefsen U, Thon T, Damkjær Moen R, Pekanovic A, Tornberg ÅB, Lauruschkus K.

PeerJ. 2019 Jun 18;7:e7098. doi: 10.7717/peerj.7098. eCollection 2019.

People with physical disabilities (PD) suffer from consequences due to lack of physical activity and consequently, are at increased risk of chronic diseases. We aimed to evaluate the ability of a motorised assistive device for dynamic standing with weight-bearing in addition to standard state-of-the-art therapy to improve clinical outcome in a meta-analysis of available studies. A total of 11 studies were identified from different European countries analysing the effect of the dynamic device Innowalk. Raw data of nine studies were pooled including a total of 31 patients observed between 2009 and 2017. Standardised questionnaires and physical outcomes were examined in this exploratory meta-analysis. We recorded patients' characteristics, duration, intensity, and location of usage as well as general clinical outcomes and improvement of passive range of motion (PROM). The analysed population consisted in 90% cases of patients younger than 18 years of age. Patients were severely disabled individuals (aged 8 (6-10) years; 58% male; 67% non-ambulatory, 86% cerebral palsy). A total of 94% used the Innowalk in a home-based or day-care setting. For nearly all individuals (94%), improvements were recorded for: walking or weight-bearing transfer ( $n = 13$ ), control/strength of the trunk or head ( $n = 6$ ), joint mobility ( $n = 14$ ), sleep ( $n = 4$  out of 6/67%), or muscle strength ( $n = 17$ ), vital functions ( $n = 16$ ), bowel function ( $n = 10$ ), attention/orientation ( $n = 2$ ). PROM of the hip (flexion, abduction, and adduction) significantly ( $p < 0.001$  for multiple comparisons) increased after 1 month ( $p < 0.05$  flexion, adduction) and further after 5 months ( $p < 0.05$  each) in contrast ( $p < 0.05$  each) to a control group with state-of-the-art therapy. Similarly, PROM showed a trend towards improvement in dorsal extension of the ankle ( $p = 0.07$ ). In summary, this is the first report of a novel device with additional benefit to standard therapy for severe PD. These intriguing results warrant the planned prospective randomised controlled trial to prove the concept and mechanism of action of this device.

PMID: [31249736](#)

### **9. EMG-Based Characterization of Walking Asymmetry in Children with Mild Hemiplegic Cerebral Palsy.**

Di Nardo F, Strazza A, Mengarelli A, Cardarelli S, Tigrini A, Verdini F, Nascimbeni A, Agostini V, Knaflitz M, Fioretti S.

Biosensors (Basel). 2019 Jun 27;9(3). pii: E82. doi: 10.3390/bios9030082.

Hemiplegia is a neurological disorder that is often detected in children with cerebral palsy. Although many studies have investigated muscular activity in hemiplegic legs, few EMG-based findings focused on unaffected limb. This study aimed to quantify the asymmetric behavior of lower-limb-muscle recruitment during walking in mild-hemiplegic children from surface-EMG and foot-floor contact features. sEMG signals from tibialis anterior (TA) and gastrocnemius lateralis and foot-floor contact data during walking were analyzed in 16 hemiplegic children classified as W1 according to Winter' scale, and in 100 control children. Statistical gait analysis, a methodology achieving a statistical characterization of gait by averaging surface-EMG-based features, was performed. Results, achieved in hundreds of strides for each child, indicated that in the hemiplegic side with respect to the non-hemiplegic side, W1 children showed a statistically significant: decreased number of strides with normal foot-floor contact; decreased stance-phase length and initial-contact sub-phase; curtailed, less frequent TA activity in terminal swing and a lack of TA activity at heel-strike. The acknowledged impairment of anti-phase eccentric control of dorsiflexors was confirmed in the hemiplegic side, but not in the contralateral side. However, a modified foot-floor contact

pattern is evinced also in the contralateral side, probably to make up for balance requirements.

PMID: [31252517](#)

#### **10. Quantifying the velocity-dependent muscle response during gait of children with Cerebral Palsy.**

Tirosh O, Rutz E.

J Electromyogr Kinesiol. 2019 Jun 22;48:76-83. doi: 10.1016/j.jelekin.2019.06.007. [Epub ahead of print]

A new method is introduced quantifying the velocity-dependent muscle response during gait in spastic muscles of children with Cerebral Palsy. The velocity-dependent muscle activation Index is calculated during a 3-dimensional gait analysis using segment angular velocity and the Instantaneous Mean Frequency calculated from surface electromyography. Typical developed children (n = 11) and children with hemiplegia (n = 11) aging from 8 to 19 years participated in the study. The rectus femoris and the medial gastrocnemius were assessed by calculating the velocity dependent muscle activation Index and the modified Ashworth Scale. Greater velocity-dependent muscle activation Index values for both medial gastrocnemius and rectus femoris muscles were associated with greater Ashworth Scale. Post hoc analysis revealed significant lower velocity-dependent muscle activation Index means in the Typical developed group compared with Ashworth Scale scores of 1, 2, 3, and 5. In addition, velocity-dependent muscle activation Index for Ashworth Scale 0, 1, and 2 were significantly lower than for Ashworth Scale 3 and 5. The velocity dependent muscle activation Index showed negative low correlation with walking speed and cadence. Findings show that spastic muscles can be quantified during dynamic functional task such as walking. Future studies should investigate the reliability of the velocity-dependent muscle activation Index that may be used for the assessment of spasticity management such as Botulinum toxin A interventions.

PMID: [31252283](#)

#### **11. Effect of a 10-Week Aquatic Exercise Training Program on Gross Motor Function in Children With Spastic Cerebral Palsy.**

Akinola BI, Gbiri CA, Odebiyi DO.

Glob Pediatr Health. 2019 Jun 25;6:2333794X19857378. doi: 10.1177/2333794X19857378. eCollection 2019.

**Introduction.** Cerebral palsy (CP) is caused by an injury to the developing brain, and abnormal gross motor function is a hallmark of CP. Properly structured exercises on land have been reported to be effective in improving functional performance in children with CP while only few have been documented on aquatic therapy. **Objective.** To investigate the effect of a 10-week aquatic exercise training program on gross motor function in children with spastic CP. **Methods.** Thirty participants aged 1 to 12 years were randomized into the experimental and control groups. Both groups received manual passive stretching and functional training exercises, depending on their level of motor impairment, either in water (temperature 28°C to 32°C) or on land. Each exercise training session lasted for about 1 hour 40 minutes, twice per week for 10 weeks in both groups. **Measurement of gross motor function** was done using Gross Motor Function Measure (GMFM-88) at baseline and after 4 weeks, 8 weeks, and 10 weeks of intervention. Both groups were compared for differences in change in gross motor function using Mann-Whitney U test. The level of significance was set at  $P < .05$ . **Results.** Only the experimental group showed significant improvement ( $P < .05$ ) in all dimensions of gross motor function except for walking, running, and jumping ( $P = .112$ ). Statistically significant difference ( $P < .05$ ) was found between both groups for all dimensions of gross motor function after 10 weeks of intervention. **Conclusion.** Aquatic exercise training program is effective in the functional rehabilitation of children with spastic CP.

PMID: [31263742](#)

#### **12. The level of accomplishment and satisfaction in activity and participation of adults with cerebral palsy and spastic diplegia.**

Eken MM, Lamberts RP, Du Toit J, Verkoeijen PPJL, Kosel E, Langerak NG.

J Orthop Sci. 2019 Jun 28. pii: S0949-2658(19)30188-5. doi: 10.1016/j.jos.2019.05.023. [Epub ahead of print]

**BACKGROUND:** Orthopaedic surgery is commonly performed in children with cerebral palsy (CP) and spastic diplegia to improve functional mobility. However, no research has quantified levels of accomplishment and satisfaction in daily activities

and participation long-term after surgery. Therefore, this study aimed to investigate 1) the level of accomplishment and satisfaction of life habits in adults with CP, 2) whether there were differences between Gross Motor Function Classification System (GMFCS) levels, and 3) associations with contextual factors, functional level and frequency of pain. **METHODS:** Levels of accomplishment and satisfaction in activity and participation were assessed using the Life-Habits 3.1 questionnaire in 30 adults with CP and spastic diplegia who received the first orthopaedic intervention more than 15 years ago (age: median [interquartile range (IQR)] = 27:8 [21:7-33:8] y:mo; GMFCS level I/II/III: n = 15/11/4). GMFCS and Functional Mobility Scale (FMS) assessed mobility over 5 m, 50 m and 500 m. Participants reported frequency of back pain and pain in the lower and upper limb. **RESULTS:** On average 63% of the participants were independent and faced no difficulties in the accomplishment of all life habits. Difficulties were mostly experienced for 'mobility', 'housing' and 'recreation' (all 61%). Participants were overall satisfied, with lowest scores for 'employment' (13% dissatisfied). Between the GMFCS levels, accomplishment scores of participants with level I were significantly higher than level II. In addition, negative associations were found between accomplishment of life habits and GMFCS level, FMS, and pain on spinal level. **CONCLUSION:** Levels of accomplishment and satisfaction were relatively high among adults with CP who underwent orthopaedic interventions during childhood. However, negative associations between accomplishment levels and level of functioning and back pain argue for rehabilitation programs specialized on these factors. This information is imperative for physicians and allied health care professionals to guide adults with CP during ageing.

PMID: [31262451](#)

### **13. Examining mobility, independence, motor function, participation, and parental stress in a school-aged Turkish cerebral palsy population: a cross-sectional study.**

Alemardoğlu-Gürbüz İ, Karakuş AB.

Neurol Sci. 2019 Jul 1. doi: 10.1007/s10072-019-03994-1. [Epub ahead of print]

**AIMS:** This study aimed to describe a school-aged Turkish cerebral palsy (CP) population in terms of gross motor function, mobility, independence, and participation, and to investigate parental stress. **METHODS:** Mobility (Functional Mobility Scale (FMS)), independence (Barthel Index (BI)), motor function (Gross Motor Function Measurement (GMFM)), functional classification (Gross Motor Function Classification System (GMFCS)), participation (Pediatric Outcome Data Collection Instrument (PODCI)), and parents' stress (Parental Stress Scale (PSS)) of 100 school-aged children with CP aged 5-15 years old were evaluated. School-related difficulties and restrictions were also questioned. **RESULTS:** Of the 100 children with GMFCS levels I-V, almost half had independent mobility on level or all surfaces according to the FMS, with a relatively high GMFM score (72.8%), and above average BI (12 from 20), and PODCI Global Functioning (62.8%) scores. Strong-to-very strong correlations were determined between all test batteries. A mean score of  $42.3 \pm 9.92$  out of 90 was obtained for parental stress with a weak correlation to the GMFCS and the child's mobility distance according to family ( $p < 0.05$ ). **CONCLUSIONS:** Turkish school-aged children with CP displayed functional abilities that are above average besides experiencing restrictions in the school environment. Parents' view on the physical condition of the school varied depending on functional and mobility levels of their children.

PMID: [31264109](#)

### **14. Italian translation and cross-cultural adaptation of the questionnaire for the assessment of quality of life in children with cerebral palsy: caregiver priorities and child health index of life with disabilities.**

Sproccati I, Bertana S, Battisti N, Feliciangeli A, Baroncini C, Zenesini C, Cersosimo A.

Minerva Med. 2019 Jun 25. doi: 10.23736/S0026-4806.19.06072-5. [Epub ahead of print]

PMID: [31256575](#)

### **15. Corrigendum to "Determinants of health-related quality of life among mothers of children with cerebral palsy" [Journal of Pediatric Nursing 44 (2019) 1-8].**

Lee MH, Matthews AK, Park C.

J Pediatr Nurs. 2019 Jun 25. pii: S0882-5963(19)30359-8. doi: 10.1016/j.pedn.2019.06.014. [Epub ahead of print]

Erratum for Determinants of Health-related Quality of Life Among Mothers of Children With Cerebral Palsy. [J Pediatr Nurs.

2019]

PMID: [31248682](#)

#### **16. Distance-Based Method used to Localize the Eyeball Effectively for Cerebral Palsy Rehabilitation.**

Sumathy G, Arokia Renjit J.

J Med Syst. 2019 Jul 2;43(8):262. doi: 10.1007/s10916-019-1405-3.

Iris plays a vital role in human life for object identification. Many models and techniques were proposed and suggested for detecting the Iris, but the accuracy was not achieved up to the level and its frequently used for biometric application. The Proposed Work divided into two steps, at first, we detect the entire eye region outer layer by using mathematics first order derivatives by applying combinations of canny edge detection and circular hough transform. The next, we detect the inner portion of eye region that is Iris region is detected by combination of sobel edge detector and circular hough transform, As the results thereby reducing the error rate, marking the edges closest to the actual edges for maximizing the localization, indicating edges and also detect the inner and outer layer of the eye portions accurately. Finally this process is applied for cerebral palsy Children to detect the misalignment of eye and obtain the deviation position and results are compared with normal children eyes. In this context, image processing techniques are being recommended as a performance evaluation tool in cerebral palsy kids.

PMID: [31267270](#)

#### **17. Longitudinal Change in Speech Rate and Intelligibility Between 5 and 7 Years in Children With Cerebral Palsy.**

Braza MD, Sakash A, Natzke P, Hustad KC.

Am J Speech Lang Pathol. 2019 Jun 28:1-13. doi: 10.1044/2019\_AJSLP-18-0233. [Epub ahead of print]

**Purpose** We examined growth between 5 and 7 years in speech intelligibility, speech rate, and intelligible words per minute (IWPM) in 3 groups of children: those who were typically developing (TD), those with cerebral palsy (CP) and clinical speech motor impairment (SMI), and those with CP and no SMI (NSMI). **Method** Twenty-six children with CP, 16 with SMI, and 10 with NSMI were each seen at 5, 6, and 7 years of age. A cross-sectional group of 30 age-matched TD children, 10 in each age group, were included as controls. All children produced a corpus of utterances of 2-7 words. **Results** All groups of children showed increases in intelligibility and IWPM between 5 and 7 years. Only children with SMI showed increases in speech rate over time. Patterns of change were similar for children in the TD and NSMI groups but different for children in the SMI group. **Conclusions** The window of time between 5 and 7 years is an important period of growth for the production of connected speech where nearly all children, regardless of group, made significant changes in speech intelligibility and IWPM. Interventions focusing specifically on enhancing intelligibility in this age range may help facilitate even further growth in children with SMI, who still had marked intelligibility reductions at 7 years of age.

PMID: [31251882](#)

#### **18. Inflammatory markers in the saliva of cerebral palsy individuals with gingivitis after periodontal treatment.**

Yoshida RA, Gorjão R, Mayer MPA, Corazza PFL, Guare RO, Ferreira ACFM, Santos MTBR.

Braz Oral Res. 2019 Jul 1;33:e033. doi: 10.1590/1807-3107bor-2019.vol33.0033.

The aim of this study was to evaluate the effect of periodontal treatment on the salivary cytokine levels and clinical parameters of individuals with cerebral palsy (CP) with gingivitis. A non-randomized, clinical trial was conducted in individuals diagnosed with spastic CP. Thirty-eight individuals were enrolled in the study and were categorized according to gingival index scores between 0-1 or 2-3, assigned to groups G2 or G1, respectively. Periodontal treatment comprised oral hygiene instructions, conventional mechanical treatment and 0.12% chlorhexidine applied as an adjunct. Clinical parameters and saliva samples were collected at baseline and at the 15-day follow-up visit. Bleeding on probing and periodontal screening and recording were determined. Non-stimulated saliva samples were obtained, and the salivary flow rate, the osmolality and the levels of cytokines IL-1 $\beta$ , IL-6, IL-8, IL-10, TNF- $\alpha$  and IL-12p70 were evaluated by a cytometric bead array. The Wilcoxon test, the Mann-Whitney test, Spearman correlation analysis, Poisson regression analysis and an adjusted analysis were performed ( $\alpha = 0.05$ ).

The groups differed significantly in periodontal clinical parameters at baseline and at follow-up. Salivary flow rate and osmolality were similar in both groups at both timepoints. However, TNF- $\alpha$  and IL-1 $\beta$  levels were higher in G1 than in G2 at baseline. Mechanical treatment resulted in improved clinical parameters for both groups. Furthermore, mechanical treatment resulted in a significant reduction in salivary IL-1 $\beta$  and IL-8 levels for both groups after treatment. Periodontal treatment performed in individuals with CP and gingivitis reduces the levels of TNF- $\alpha$ , IL-1 $\beta$ , IL-6 and IL-8.

PMID: [31269113](#)

### **19. Cognitive outcome of early school-aged children born very preterm is not predicted by early short-term amplitude-integrated electroencephalography.**

Feldmann M, Rousson V, Nguyen TD, Bernet V, Hagmann C, Latal B, Natalucci G.

Acta Paediatr. 2019 Jun 29. doi: 10.1111/apa.14919. [Epub ahead of print]

AIM: We investigated the association between early amplitude-integrated electroencephalography (aEEG) and cognitive outcome in very preterm infants at early school-age. METHODS: This prospective cohort study, conducted in the Department of Neonatology, University Hospital Zurich, Switzerland, from 2009-2012, comprised infants born at less than 32 weeks of gestation, who underwent continuous aEEG recording during the first four days of life. Cognitive outcome was assessed with the Kaufman-Assessment Battery for Children at five years. Univariate and multivariate logistic regressions were calculated between aEEG parameters and normal cognitive outcome, defined as an intelligence quotient (IQ) of at least 85. RESULTS: The 118 (52.5% male) infants were born at a mean gestational age of 29.9 weeks and a mean birth weight of 1,235  $\pm$  363 grams. We followed up 89 children at the age of five and they had a mean IQ of 97.8  $\pm$  12.7 with 21.3% under 85 - and 2.2% had cerebral palsy. Univariate analyses found associations between aEEG measures and normal cognitive outcome, but these were no longer significant after adjustment for confounders. Socioeconomic status and neonatal morbidity were independent predictors of cognitive outcome. CONCLUSION: Early short-term aEEG did not predict later cognitive outcome in our cohort of very preterm infants. This article is protected by copyright. All rights reserved.

PMID: [31254357](#)

### **20. Comorbidities in cerebral palsy: a patient registry study.**

Hollung SJ, Bakken IJ, Vik T, Lydersen S, Wiik R, Aaberg KM, Andersen GL.

Dev Med Child Neurol. 2019 Jul 4. doi: 10.1111/dmcn.14307. [Epub ahead of print]

AIM: To describe the total burden of disease in individuals with cerebral palsy (CP) in Norway. METHOD: A comprehensive set of disorder categories were extracted from the Norwegian Patient Registry using International Statistical Classification of Diseases, 10th Revision diagnosis codes for individuals born between 1996 and 2010 who received specialist healthcare between 2008 and 2017 (0-21y). Individuals with CP were identified through a validation study in cooperation with the Cerebral Palsy Registry of Norway. Risk differences (proportions of individuals recorded with each disorder) were used to compare individuals with CP with the general population without CP. RESULTS: The study included 966 760 individuals. Among these, 2302 (0.24%) had CP (1330 males, 972 females). Of the individuals with CP, 95.0% were recorded with one or more comorbidity, and the risks of medical, neurological, and mental/behavioural disorders were higher compared with the risks in the general population. The most common neurological and mental/behavioural disorders were cocausal, i.e. attributed to the same injury to the developing brain that caused CP, while medical disorders were most often complications of CP or coincidentally co-occurring with CP. INTERPRETATION: Individuals with CP have a considerably higher burden of medical, neurological, and mental/behavioural disorders compared with the general population, including disorders that are not directly caused by, or complications to, the brain injury. WHAT THIS PAPER ADDS: Nearly all individuals with cerebral palsy (CP) had one or more comorbidity. Fifty-two per cent had at least one comorbidity attributed to the same cause as CP, complications of CP, and coincidentally co-occurring with CP. Risks of medical, neurological, and mental/behavioural disorders were considerably higher than in the general population.

PMID: [31273772](#)

### **21. Investigating the Feasibility of a Modified Quantitative Sensory Testing Approach to Profile Sensory Function and Predict Pain Outcomes Following Intrathecal Baclofen Implant Surgery in Cerebral Palsy.**

Barney CC, Merbler AM, Simone DA, Walk D, Symons FJ.

Pain Med. 2019 Jul 3. pii: pnz114. doi: 10.1093/pm/pnz114. [Epub ahead of print]

**OBJECTIVES:** Intrathecal baclofen (ITB) pumps used to manage spasticity in children with cerebral palsy (CP) also improve pain outcomes for some but not all patients. The purpose of this clinical feasibility study was to explore whether a quantitative sensory testing approach could a) be modified and used to subgroup individuals into sensory profiles and b) test whether the profiles were related to postimplant pain outcomes (i.e., pain responsive or pain persistent). **SUBJECTS:** A purposeful clinical sample of nine children with CP (mean age = 12.5 years, male = 56%) and complex communication needs participated. **METHODS:** A prospective within-subject design was used to measure proxy-reported pain before and after ITB implant. Pain response status was determined by proxy-reported pain intensity change (>50% change in maximum rated intensity). A modified quantitative sensory testing (mQST) procedure was used to assess behavioral responsivity to an array of calibrated sensory (tactile/acute nociceptive) stimuli before surgery. **RESULTS:** Seven individuals with presurgical pain had mQST differentiated sensory profiles in relation to ITB pain outcomes and relative to the two individuals with no pain. Presurgically, the ITB pain responsive subgroup (N = 3, maximum rated pain intensity decreased >50% after ITB implant) showed increased behavioral reactivity to an acute nociceptive stimulus and cold stimulus, whereas the ITB pain persistent subgroup (N = 4) showed reduced behavioral reactivity to cold and repeated von Frey stimulation relative to the no pain individuals. **CONCLUSION:** Implications for patient selection criteria and stratification to presurgically identify individuals with CP "at risk" for persistent postprocedure pain are discussed.

PMID: [31268147](#)

## 22. Hormonal Contraceptive Prescription in Young Women With Cerebral Palsy.

Flavin M, Shore BJ, Miller P, Gray S.

J Adolesc Health. 2019 Jun 24. pii: S1054-139X(19)30168-5. doi: 10.1016/j.jadohealth.2019.03.010. [Epub ahead of print]

**PURPOSE:** The purpose of the study was to describe the prevalence and patterns of prescription of hormonal contraceptive medications to young women with cerebral palsy (CP) and determine if CP topography or ambulatory status was associated with the type of contraceptive prescribed. **METHODS:** Data were extracted by manual chart review for women with CP between the ages of 15 and 25 years who were seen at a tertiary pediatric hospital and a rehabilitation hospital between the years of 2011 and 2013. CP topography was defined as the number and pattern of limbs affected (hemiplegia, diplegia, triplegia, or quadriplegia), and ambulatory status was defined as whether a wheelchair was used for community mobility. Logistic regression analysis was used to assess associations between patient age, CP topography, ambulatory status, and contraceptive prescription. **RESULTS:** Data were collected for 483 women with CP with an average age of 19 years (standard deviation: 3 years). One hundred thirty-one patients (27%) were prescribed hormonal contraceptives. Estrogen-progestin combined oral contraceptives were most frequently prescribed (73%). Prescription of hormonal contraceptives was not associated with CP topography ( $p = .95$ ) or ambulatory status ( $p = .44$ ); however, older subjects were more likely to be prescribed hormonal contraceptives ( $p = .01$ ). There was no association detected between CP topography and contraceptive composition ( $p = .09$ ) or between ambulatory status and contraceptive composition ( $p = .06$ ). There was also no association detected between CP topography ( $p = .18$ ) or ambulatory status ( $p = .09$ ) and depot medroxyprogesterone acetate prescription. **CONCLUSION:** Ambulatory status and CP topography were not associated with the types of hormonal contraceptives prescribed in this cohort.

PMID: [31248805](#)

## 23. Respiratory hospital admissions and emergency department visits in young people with cerebral palsy: 5-year follow-up.

Blackmore AM, Bear N, Langdon K, Moshovis L, Gibson N, Wilson A.

Arch Dis Child. 2019 Jun 29. pii: archdischild-2019-317714. doi: 10.1136/archdischild-2019-317714. [Epub ahead of print]

PMID: [31256055](#)

## 24. Interventions for management of respiratory disease in young people with cerebral palsy: A systematic review.

Blackmore AM, Gibson N, Cooper MS, Langdon K, Moshovis L, Wilson AC.

Child Care Health Dev. 2019 Jul 5. doi: 10.1111/cch.12703. [Epub ahead of print]

**BACKGROUND:** Respiratory disease is a leading cause of hospitalizations and deaths in young people with cerebral palsy

(CP). It is insidious and multifactorial. Clinical management can be complex. This systematic review describes effects of interventions for the prevention and management of respiratory disease in young people with CP. **METHODS:** Nine databases (Cochrane, CINAHL, Embase, EMCare, MEDLINE, PEDro, OpenGrey, ScienceDirect, and SpeechBITE) were searched. Eligibility criteria were as follows: the population included at least 50% individuals with CP aged under 26 years; the intervention was for chronic respiratory illness; the outcomes were any measurable indicators of respiratory health or morbidity; the study design could be any original study reporting effects of an intervention on measurable outcomes; the study was published January 1998 or later. The American Academy for Cerebral Palsy and Developmental Medicine (AAPDM) Methodology guided study appraisal and synthesis. The review was registered with PROSPERO (reference number CRD42018086314). **RESULTS:** The search yielded 3347 papers; 37 papers (reporting 34 studies) of these met the eligibility criteria. They included 582 participants with CP (ranging from 1 to 77 across studies) with ages from 5 months to 25 years. Interventions were diverse and included: airway clearance techniques, exercise, positioning, mealtime management, salivary management, upper airway interventions, antibiotics, gastro-intestinal interventions, and spinal surgery. There were no interventions aimed at prevention of respiratory disease in this population. Research designs were classified as levels II (n = 3), III (n = 2), IV (n = 25) and V (n = 4). **CONCLUSIONS:** Evidence for most respiratory interventions for young people with CP is absent or weak. No controlled trials demonstrated significant effects on respiratory morbidity, owing to their scarcity, weak designs, and inadequate power. There is an urgent need for well-designed prospective controlled studies investigating prevention and management of respiratory disease in young people with CP.

PMID: [31276598](#)

## 25. Respiratory Complications After Posterior Spinal Fusion for Neuromuscular Scoliosis: Children With Rett Syndrome at Greater Risk Than Those With Cerebral Palsy.

Cohen JL, Klyce W, Kudchadkar SR, Kotian RN, Sponseller PD.

Spine (Phila Pa 1976). 2019 Jun 27. doi: 10.1097/BRS.0000000000003075. [Epub ahead of print]

**MINI:** We investigated immediate postoperative outcomes of children with Rett syndrome versus cerebral palsy after undergoing posterior spinal fusion. Children with Rett syndrome had more respiratory failure, more need for positive pressure ventilation, and longer intensive care unit stays, despite better preoperative motor function and shorter surgeries. **STUDY DESIGN:** Retrospective cohort. **OBJECTIVE:** To determine how respiratory failure rates and duration of intensive care unit (ICU) stay after posterior spinal fusion (PSF) for neuromuscular scoliosis compare between children with Rett syndrome (RS) versus cerebral palsy (CP). **SUMMARY OF BACKGROUND DATA:** Rett syndrome and CP are associated with high incidence of neuromuscular scoliosis and respiratory dysfunction. **METHODS:** We included 21 patients with RS (mean age, 13 ± 3.1 yrs) and 124 with CP (mean age, 14 ± 3.2 yrs) who underwent PSF by one surgeon from 2004 to 2017. Preoperative motor function was assessed using the Gross Motor Function Classification System (GMFCS). Primary outcomes were respiratory failure and duration of ICU stay. Secondary outcomes were pneumonia and prolonged use of positive pressure ventilation (PPV). Using multivariate regression, we identified associations of age, intraoperative vital signs, duration of hospital stay, number of vertebral levels fused, anesthesia and surgery durations, and estimated blood loss with longer ICU stay and respiratory failure. **RESULTS:** A greater proportion of CP patients (96%) than RS patients (66%) were in GMFCS IV or V (P < 0.01). Respiratory failure was more common in RS patients (43% vs. 19%; P = 0.02), as was PPV (67% vs. 31%; P < 0.01). RS patients had shorter median durations of anesthesia and surgery (P < 0.01). RS patients had a longer median (interquartile range) ICU stay (4 days [1-5] vs. 2 days [2-19]; P = 0.01). Incidence of pneumonia did not differ between groups (P = 0.69). Only RS diagnosis (P = 0.02) and prolonged PPV (P < 0.01) were associated with longer ICU stay. **CONCLUSION:** Despite better preoperative motor function and shorter anesthesia and surgery durations, patients with RS experienced more respiratory failure, prolonged PPV use, and longer ICU stays after PSF than did children with CP. **LEVEL OF EVIDENCE:** 4.

PMID: [31261282](#)

## 26. [Refugee/immigrant children with cerebral palsy in the Swedish health care organization].

Westbom L, Hägglund G.

Lakartidningen. 2019 Jul 1;116. pii: FL9L. [Article in Swedish]

Cerebral palsy (CP) is present in about 200 children per birth-year cohort in Sweden. From 2001 to 2016, the annual number of immigrants to Sweden with CP enrolled at the (re)habilitation services increased from less than ten to 40-90 individuals per year; about 70 % came to Sweden as refugees. At a group level, children with CP born abroad had greater functional impairment than children born in Sweden, based on information in the Swedish national surveillance program and health care quality register for CP (CPUP). There was a significantly higher prevalence of CP, a greater proportion of children with bilateral spastic CP, and a lower proportion with unilateral spastic CP among the immigrants. The proportion of children in

each gross motor function level treated with orthoses, standing frames, spinal brace or botulinum toxin was the same regardless of whether the child was born in Sweden or abroad. In summary, the (re)habilitation services and orthopedics have managed to provide a relatively large group of immigrants/refugees with CP with equal treatment compared to children born in Sweden.

PMID: [31265117](#)

### **27. The Impact of Selective Fetal Growth Restriction or Birth Weight Discordance on Long-Term Neurodevelopment in Monochorionic Twins: A Systematic Literature Review.**

Groene SG, Tollenaar LSA, Oepkes D, Lopriore E, van Klink JMM.

J Clin Med. 2019 Jun 28;8(7). pii: E944. doi: 10.3390/jcm8070944.

The aim of this review was to assess the impact of selective fetal growth restriction (sFGR) and/or birth weight discordance (BWD) on long-term neurodevelopment in monochorionic (MC) twins. Five out of 28 articles assessed for eligibility were included. One article concluded that the incidence of long-term neurodevelopmental impairment (NDI) was higher in BWD MC twins (11/26, 42%) than in BWD dichorionic (DC) (5/38, 13%) and concordant MC twins (6/71, 8%). BWD MC twins had a 6-fold higher risk of cerebral palsy compared to DC twins (5/26, 19% vs. 1/40, 3%,  $p < 0.05$ ). Another article described a linear relationship between birth weight and verbal IQ scores, demonstrating a 13-point difference for a 1000 gram BWD between the twins, with a disadvantage for the smaller twin ( $p < 0.0001$ ). Three articles analyzing within-pair differences showed that the smaller twin more frequently demonstrated mild NDI (6/80, 8% vs. 1/111, 1%) and lower developmental test scores (up to 5.3 points) as opposed to its larger co-twin. Although these results suggest that MC twins with sFGR/BWD are at increased risk of long-term NDI as compared to BWD DC or concordant MC twins, with a within-pair disadvantage for the smaller twin, the overall level of evidence is of moderate quality. As only five articles with a high degree of heterogeneity were available, our review mainly demonstrates the current lack of knowledge of the long-term outcomes of MC twins with sFGR/BWD. Insight into long-term outcomes will lead to improved prognostics, which are essential in parent counseling and crucial in the process of forming a management protocol specifically for twins with sFGR to optimally monitor and support their development.

PMID: [31261823](#)

### **28. Understanding long-term neurodevelopmental outcomes of very and extremely preterm infants: A clinical review.**

Jois RS.

Aust J Gen Pract. 2019 Jan-Feb;48(1-2):26-32.

**BACKGROUND:** Survival of infants born at <32 weeks of gestation has increased over recent years. This has resulted in an increased incidence of neurodevelopmental morbidities in survivors. **OBJECTIVE:** The aim of this article is to provide a pragmatic clinical review of long-term neurodevelopmental risk experienced by very preterm infants. **DISCUSSION:** Very preterm infants have a higher risk of cerebral palsy, cognitive delay, deafness and blindness, and autism spectrum disorder when compared with term controls. The presence of Grade 3 or 4 intraventricular haemorrhage or necrotising enterocolitis increased the risk of cerebral palsy, while magnesium sulphate for threatened preterm labour decreased the risk in the surviving neonate. Most of the neurodevelopmental conditions can be diagnosed in early childhood through regular follow-up. General practitioners need to be vigilant about early signs of developmental problems affecting preterm survivors. Regular follow-up is necessary to identify red flags in early development.

PMID: [31256447](#)

### **29. Neuromodulation for children with cerebral palsy.**

Meoni S, Moro E.

Dev Med Child Neurol. 2019 Jul 4. doi: 10.1111/dmcn.14311. [Epub ahead of print]

PMID: [31273761](#)

### **30. Preterm children with suspected cerebral palsy at 19 months corrected age in the Canadian neonatal follow-up**

**network.**

Synnes A, Gillone J, Majnemer A, Lodha A, Creighton D, Moddemann D, Shah PS; Canadian and Neonatal Network; Canadian and Neonatal Follow-up Network.

Early Hum Dev. 2019 Jul 1;136:7-13. doi: 10.1016/j.earlhumdev.2019.06.009. [Epub ahead of print]

**BACKGROUND:** The ability to definitively diagnose cerebral palsy (CP) at 18-24 months is unknown. **AIMS:** To describe very preterm children who, at 19 months, have suspected CP defined as neither having a definitive diagnosis of CP nor no CP and compare them with children with and without CP. **STUDY DESIGN AND METHODS:** Longitudinal national cohort study of births <29 weeks' gestation with linked Canadian Neonatal Network and Canadian Neonatal Follow-up Network data with 19 month assessments and 3-year questionnaires (Ages and Stages-3 and Health Status Classification System-Preschool). CP, no CP and suspected CP groups, classified at 19 months, were compared using chi square and ANOVA. **RESULTS:** Of 3086 survivors, 2280 had complete 19-month corrected age (CA) and 1261 had 3-year CA data. Suspected CP (3.6%), CP (6.4%) and no CP (90%) groups differed ( $p < 0.05$ ) in birth weight, gestational age, complications of prematurity and NICU length of stay. Children with suspected CP had Bayley-III motor, cognitive and language composite scores at 18 months midway between CP and no CP, had the lowest sensory impairment rates and highest hospital readmission rates. At 3 years, gross motor, fine motor, problem-solving, communication and social skill abilities differed: abnormal outcomes were intermediate for children with suspected CP ( $p < 0.01$ ). **CONCLUSIONS:** CP incidence varied from 6.4% to 10% with exclusion or inclusion of children with suspected CP. Children with suspected CP have characteristics mostly midway between those with and without CP and developmental concerns persist to 3 years and require surveillance beyond 19 months.

PMID: [31271995](#)

**31. Losing a diagnosis of cerebral palsy: a comparison of variables at 2 and 5 years.**

Chen A, Dyck Holzinger S, Oskoui M, Shevell M; Canadian Cerebral Palsy Registry.

Dev Med Child Neurol. 2019 Jul 4. doi: 10.1111/dmcn.14309. [Epub ahead of print]

**AIM:** This study aims to identify characteristics at 2 years of age that differ between children with confirmed cerebral palsy (CP) and a non-CP diagnosis by 5 years of age. **METHOD:** This was a retrospective cohort analysis. A CP diagnosis may be considered a 'probable' diagnosis at 2 years, which is often 'confirmed' at 4 or 5 years, particularly in the context of CP registries. A total of 1683 children with a diagnosis of CP or probable CP at 2 years of age were identified from the Canadian Cerebral Palsy Registry, of whom 48 received a non-CP diagnosis at 5 years ('non-confirmed CP'). Perinatal adversity, preterm birth status, Gross Motor Function Classification System (GMFCS) level, presence of comorbidities, magnetic resonance imaging (MRI) findings, and initial CP motor type were compared between the two groups by univariate and logistic regression analyses. **RESULTS:**  $\chi^2$  analysis and multivariate analysis both confirmed that children with a non-CP diagnosis by 5 years of age were more likely to have a normal MRI ( $\chi^2$  odds ratio [OR]=7.8, 95% confidence interval [CI]=3.8-16.1; OR=5.4, 95% CI=2.4-12.5), ataxic-hypotonic ( $\chi^2$  OR=10.1, 95% CI=4.9-21.2; OR=6.1, 95% CI=2.2-16.2) or dyskinetic CP ( $\chi^2$  OR=2.7, 95% CI=1.2-5.9; OR=2.9, 95% CI=1.0-7.6), born at term ( $\chi^2$  OR=3.7, 95% CI=1.7-8.0; OR=3.6, 95% CI=1.0-12.1), and lack perinatal adversity ( $\chi^2$  OR=4.1, 95% CI=1.6-10.7; OR=3.4, 95% CI=1.0-11.7). **INTERPRETATION:** Normal MRI, ataxic-hypotonic or dyskinetic CP, lack of perinatal adversity, and term birth are associated with a higher odds of non-CP diagnosis by 5 years of age, thus potentially enhancing diagnostic work-up. **WHAT THIS PAPER ADDS:** Normal magnetic resonance imaging (MRI) at 2 years was associated with a non-cerebral palsy (CP) diagnosis by 5 years. Diagnosis of ataxic-hypotonic or dyskinetic CP motor subtype at 2 years was associated with a non-CP diagnosis by 5 years. Perinatal adversity and preterm birth were rarer with a non-CP diagnosis by 5 years.

PMID: [31273776](#)

**32. 'Outgrowing' a cerebral palsy diagnosis.**

Nelson KB1.

Dev Med Child Neurol. 2019 Jul 4. doi: 10.1111/dmcn.14308. [Epub ahead of print]

PMID: [31273756](#)

**33. Lentivirus-mediated microRNA-26a-modified neural stem cells improve brain injury in rats with cerebral palsy.**

## Prevention and Cure

Guo Q, Zhang J, Zheng Z, Li X, Wang F, Liu S.

J Cell Physiol. 2019 Jul 2. doi: 10.1002/jcp.29043. [Epub ahead of print]

This study is launched to investigate the effect of lentivirus-mediated microRNA-26a (miR-26a)-modified neural stem cells (NSCs) in brain injury in rats with cerebral palsy (CP). The successfully constructed miR-26a lentivirus expression vector and empty vector virus were used to modify NSCs. The model of CP with ischemia and anoxia was established in rats. NSCs and miR-26a-NSCs were stereoscopically injected into the cerebral cortex of the modeled rats, respectively. The survival and migration of NSCs infected with recombinant lentivirus expressing green fluorescence in vivo was observed under a light microscope. The neurobehavioral functions, morphology, and ultrastructure of cerebral cortex and hippocampus, apoptosis of brain cells, expression of apoptosis-related protein caspase-3 and Bax, together with the expression of the glial fibrillary acidic protein (GFAP) in cerebral cortex and hippocampus were determined. Expression of miR-26a in NSCs infected with pLVTHM-miR-26a increased significantly. After NSCs transplantation, the neurobehavioral status of CP rats was improved, the degree of brain pathological injury was alleviated, the apoptotic index of cells in cerebral cortex and hippocampus and the expression of the apoptotic protein (caspase-3 and Bax) were decreased, the expression of GFAP were significantly decreased. After miR-26a-NSCs transplantation, these aforementioned results further improved or decreased. Our study suggests that miR-26a-modified NSCs mediated by lentivirus can improve brain injury, inhibit apoptosis of brain cells and activation of astrocytes in CP rats.

PMID: [31264214](#)

### **34. Effect of allopurinol in addition to hypothermia treatment in neonates for hypoxic-ischemic brain injury on neurocognitive outcome (ALBINO): study protocol of a blinded randomized placebo-controlled parallel group multicenter trial for superiority (phase III).**

Maiwald CA, Annink KV, Rüdiger M, Benders MJNL, van Bel F, Allegaert K, Naulaers G, Bassler D, Klebermaß-Schrehof K, Vento M, Guimarães H, Stiris T, Cattarossi L, Metsäranta M, Vanhatalo S, Mazela J, Metsvaht T, Jacobs Y, Franz AR; ALBINO Study Group.

BMC Pediatr. 2019 Jun 27;19(1):210. doi: 10.1186/s12887-019-1566-8.

**BACKGROUND:** Perinatal asphyxia and resulting hypoxic-ischemic encephalopathy is a major cause of death and long-term disability in term born neonates. Up to 20,000 infants each year are affected by HIE in Europe and even more in regions with lower level of perinatal care. The only established therapy to improve outcome in these infants is therapeutic hypothermia. Allopurinol is a xanthine oxidase inhibitor that reduces the production of oxygen radicals as superoxide, which contributes to secondary energy failure and apoptosis in neurons and glial cells after reperfusion of hypoxic brain tissue and may further improve outcome if administered in addition to therapeutic hypothermia. **METHODS:** This study on the effects of ALlopurinol in addition to hypothermia treatment for hypoxic-ischemic Brain Injury on Neurocognitive Outcome (ALBINO), is a European double-blinded randomized placebo-controlled parallel group multicenter trial (Phase III) to evaluate the effect of postnatal allopurinol administered in addition to standard of care (including therapeutic hypothermia if indicated) on the incidence of death and severe neurodevelopmental impairment at 24 months of age in newborns with perinatal hypoxic-ischemic insult and signs of potentially evolving encephalopathy. Allopurinol or placebo will be given in addition to therapeutic hypothermia (where indicated) to infants with a gestational age  $\geq 36$  weeks and a birth weight  $\geq 2500$  g, with severe perinatal asphyxia and potentially evolving encephalopathy. The primary endpoint of this study will be death or severe neurodevelopmental impairment versus survival without severe neurodevelopmental impairment at the age of two years. Effects on brain injury by magnetic resonance imaging and cerebral ultrasound, electric brain activity, concentrations of peroxidation products and S100B, will also be studied along with effects on heart function and pharmacokinetics of allopurinol after iv-infusion. **DISCUSSION:** This trial will provide data to assess the efficacy and safety of early postnatal allopurinol in term infants with evolving hypoxic-ischemic encephalopathy. If proven efficacious and safe, allopurinol could become part of a neuroprotective pharmacological treatment strategy in addition to therapeutic hypothermia in children with perinatal asphyxia. **TRIAL REGISTRATION:** NCT03162653, www.ClinicalTrials.gov, May 22, 2017.

PMID: [31248390](#)