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Interventions and Management

1. Differences in coordination and timing of pre-reaching upper extremity movements may be an indicator of cerebral palsy in infants with stroke: A preliminary investigation.

Mazzarella J, McNally M, Chaudhari AMW, Pan X, Heathcock JC.

Clin Biomech (Bristol, Avon). 2020 Jan 7;73:181-188. doi: 10.1016/j.clinbiomech.2019.12.024. [Epub ahead of print]

BACKGROUND: Neonatal stroke is a leading cause of hemiplegic cerebral palsy that occurs around the time of birth. Infants are diagnosed with cerebral palsy when motor impairments become clinically apparent, months or years after the stroke. Tools/methods for identifying high risk or diagnosis of cerebral palsy in infancy are improving. **METHODS:** We measured spatial and temporal kinematics of pre-reaching upper extremity movements in 2-3 month old infants with neonatal stroke and typical development. We aimed to evaluate the feasibility of applying kinematics in this population and collect preliminary data to explore (1) if asymmetries are present in the infants with neonatal stroke, particularly those with a later diagnosis of cerebral palsy, and (2) to compare differences in the timing and coordination of their movements to infants with typical development, and infants with stroke and no cerebral palsy. Participants were 21 full-term infants, 10 with stroke (4 who later received a cerebral palsy diagnosis) age 72.1 (SD 9.3) days, and 11 typically developing, age 74.3 (SD 9.3) days. **FINDINGS:** Results showed that infants with stroke and cerebral palsy demonstrated significant asymmetry in the average movement length ($p = 0.0089$) and hand path length ($p = 0.0275$) between their involved and uninvolved sides and moved less frequently ($p = 0.09$) and slower ($p = 0.041$) than infants with stroke and no cerebral palsy. **INTERPRETATION:** Results suggest that kinematic analysis might detect asymmetries and motor impairment indicative of hemiplegic cerebral palsy earlier than current assessments and that asymmetry in speed, length and frequency of arm movements may be early indicators. This study is preliminary, limiting interpretation of the results.

PMID: [32007826](https://pubmed.ncbi.nlm.nih.gov/32007826/)

2. The role of selective dorsal rhizotomy in the management of post-traumatic spasticity: systematic review.

Agrawal M, Samala R, Doddamani R, Agrawal D, Chandra SP.

Neurosurg Rev. 2020 Feb 5. doi: 10.1007/s10143-020-01255-w. [Epub ahead of print]

There is a huge burden of patients suffering from trauma-induced disabling spasticity the world over. There are surprisingly few modalities of treatment with a sustained, proven benefit which can be offered to such patients. Selective dorsal rhizotomy (SDR) has been used with proven success in treating spasticity in patients of cerebral palsy, both in children and in adults. The rationale behind using the procedure in post-traumatic cases is reviewed, along with the cases reported till date in the world literature. The indications, surgical procedure used, outcome and complications, if any, are described. Most of the cases described in the literature have shown a favourable outcome with minimal complications. SDR can become an important tool in the armamentarium of the clinician treating this condition.

PMID: [32020384](#)

3. Selective dorsal rhizotomy: an illustrated review of operative techniques.

Warsi NM, Tailor J, Coulter IC, Shakil H, Workewych A, Haldenby R, Breitbart S, Strantzas S, Vandenberg M, Dewan MC, Ibrahim GM.

J Neurosurg Pediatr. 2020 Feb 7:1-8. doi: 10.3171/2019.12.PEDS19629. [Epub ahead of print]

OBJECTIVE: Selective dorsal rhizotomy (SDR) is a procedure primarily performed to improve function in a subset of children with limitations related to spasticity. There is substantial variability in operative techniques among centers and surgeons. Here, the authors provide a technical review of operative approaches for SDR. **METHODS:** Ovid MEDLINE, Embase, and PubMed databases were queried in accordance with PRISMA guidelines. All studies included described a novel surgical technique. The technical nuances of each approach were extracted, including extent of exposure, bone removal, and selection of appropriate nerve roots. The operative approach preferred at the authors' institution (the "2 × 3 exposure") is also detailed. **RESULTS:** Five full-text papers were identified from a total of 380 articles. Operative approaches to SDR varied significantly with regard to level of exposure, extent of laminectomy, and identification of nerve roots. The largest exposure involved a multilevel laminectomy, while the smallest exposure involved a keyhole interlaminar approach. At the Hospital for Sick Children, the authors utilize a two-level laminoplasty at the level of the conus medullaris. The benefits and disadvantages of the spectrum of techniques are discussed, and illustrative figures are provided. **CONCLUSIONS:** Surgical approaches to SDR vary considerably and are detailed and illustrated in this review as a guide for neurosurgeons. Future studies should address the long-term impact of these techniques on functional outcomes and complications such as spinal deformity.

PMID: [32032949](#)

4. Biomechanical Comparison of Two Pediatric Blade Plate Designs in Proximal Femoral Osteotomies.

Ruzbarsky JJ, Swarup I, Garner MR, Meyers KN, Edobor-Osula F, Widmann RF, Scher DM.

HSS J. 2020 Feb;16(1):81-85. doi: 10.1007/s11420-019-09675-1. Epub 2019 Mar 26.

BACKGROUND: Blade plates are frequently used for internal fixation following proximal femoral varus rotational osteotomy to treat hip dysplasia in children with cerebral palsy. Recently, cannulated blade plates with the option for a proximal locking screw have demonstrated ease of insertion and low complication rates. Although there are two commonly used blade plates with a proximal screw option, no comparison of their biomechanical profiles has been undertaken. **QUESTIONS/PURPOSES:** Our study sought to compare the structural properties under axial loading, as well as the biomechanical contribution of a proximal screw, of two different 90° cannulated blade plates designed for pediatric proximal femurs. Plate A has a hole distal to the blade designed to attach a plate inserter, through which a 3.5-mm non-locking cortical screw could be placed. Plate B has a threaded hole distal to the blade designed to accept a 3.5-mm locking screw. **METHODS:** Plate A and plate B were inserted into 33 left pediatric synthetic proximal femurs. Axial loading to failure of plate A with and without a proximal screw was compared to that of plate B with and without a proximal screw. An additional 10 samples using plate B, with and without a proximal locking screw, were tested in tension to quantify the effect of the proximal screw on pullout strength. **RESULTS:** Plate B failed at a higher axial load than plate A. The addition of a proximal screw did not affect the axial load to failure for either plate. Pullout testing revealed that blade plates fixed with the proximal screw failed in tension at a significantly higher load (856.3 ± 120.9 N) than those without proximal fixation (68.1 ± 9.3 N, $p < 0.001$). **CONCLUSIONS:** Plate B failed at a higher axial load in biomechanical testing, likely related to differences in its design. The addition of a proximal screw did not increase the axial loading properties of the blade plate construct but did increase the pullout strength by a factor of 12. These results may be used to influence implant selection and post-operative rehabilitation following proximal femoral osteotomies in children.

PMID: [32015744](#)

5. Randomized controlled trial combining constraint-induced movement therapy and action-observation training in unilateral cerebral palsy: clinical effects and influencing factors of treatment response.

Simon-Martinez C, Maillieux L, Hoskens J, Ortibus E, Jaspers E, Wenderoth N, Sgandurra G, Cioni G, Molenaers G, Klingels

K, Feys H.

Ther Adv Neurol Disord. 2020 Jan 6;13:1756286419898065. doi: 10.1177/1756286419898065. eCollection 2020.

INTRODUCTION: Constraint-induced movement therapy (CIMT) improves upper limb (UL) motor execution in unilateral cerebral palsy (uCP). As these children also show motor planning deficits, action-observation training (AOT) might be of additional value. Here, we investigated the combined effect of AOT to CIMT and identified factors influencing treatment response. **METHODS:** A total of 44 children with uCP (mean 9 years 6 months, SD 1 year 10 months) participated in a 9-day camp wearing a splint for 6 h/day and were allocated to the CIMT + AOT (n = 22) and the CIMT + placebo group (n = 22). The CIMT + AOT group received 15 h of AOT (i.e. video-observation) and executed the observed tasks, whilst the CIMT + AOT group watched videos free of biological motion and executed the same tasks. The primary outcome measure was bimanual performance. Secondary outcomes included measures of body function and activity level assessed before (T1), after the intervention (T2), and at 6 months follow-up (T3). Influencing factors included behavioural and neurological characteristics. **RESULTS:** Although no between-groups differences were found ($p > 0.05$; $\eta^2 = 0-16$), the addition of AOT led to higher gains in children with initially poorer bimanual performance ($p = 0.02$; $\eta^2 = 0.14$). Both groups improved in all outcome measures after the intervention and retained the gains at follow up ($p < 0.01$; $\eta^2 = 0.02-0.71$). Poor sensory function resulted in larger improvements in the total group ($p = 0.03$; $\eta^2 = 0.25$) and high amounts of mirror movements tended to result in a better response to the additional AOT training ($p = 0.06$; $\eta^2 = 0.18$). Improvements were similar irrespective of the type of brain lesion or corticospinal tract wiring pattern. **CONCLUSIONS:** Adding AOT to CIMT, resulted in a better outcome for children with poor motor function and high amounts of mirror movements. CIMT with or without AOT seems to be more beneficial for children with poor sensory function. **TRIAL REGISTRATION:** Registered at ClinicalTrials.gov on 22nd August 2017 (ClinicalTrials.gov identifier: NCT03256357).

PMID: [32031542](#)

6. Concurrent Validity and Reliability of an Inertial Measurement Unit for the Assessment of Craniocervical Range of Motion in Subjects with Cerebral Palsy.

Carmona-Pérez C1,2, Garrido-Castro JL3,4, Torres Vidal F3, Alcaraz-Clariana S2,5, García-Luque L2, Albuquerque-Sendín F4,5, Rodrigues-de-Souza DP5.

Diagnostics (Basel). 2020 Feb 1;10(2). pii: E80. doi: 10.3390/diagnostics10020080.

OBJECTIVE: This study aimed to determine the validity and reliability of Inertial Measurement Units (IMUs) for the assessment of craniocervical range of motion (ROM) in patients with cerebral palsy (CP). **METHODS:** twenty-three subjects with CP and 23 controls, aged between 4 and 14 years, were evaluated on two occasions, separated by 3 to 5 days. An IMU and a Cervical Range of Motion device (CROM) were used to assess craniocervical ROM in the three spatial planes. Validity was assessed by comparing IMU and CROM data using the Pearson correlation coefficient, the paired t-test and Bland-Altman plots. Intra-day and inter-day relative reliability were determined using the Intraclass Correlation Coefficient (ICC). The Standard Error of Measurement (SEM) and the Minimum Detectable Change at a 90% confidence level (MDC90) were obtained for absolute reliability. **RESULTS:** High correlations were detected between methods in both groups on the sagittal and frontal planes ($r > 0.9$), although this was reduced in the case of the transverse plane. Bland-Altman plots indicated bias below 5° , although for the range of cervical rotation in the CP group, this was 8.2° . The distance between the limits of agreement was over 23.5° in both groups, except for the range of flexion-extension in the control group. ICCs were higher than 0.8 for both comparisons and groups, except for inter-day comparisons of rotational range in the CP group. Absolute reliability showed high variability, with most SEM below 8.5° , although with worse inter-day results, mainly in CP subjects, with the MDC90 of rotational range achieving more than 20° . **CONCLUSIONS:** IMU application is highly correlated with CROM for the assessment of craniocervical movement in CP and healthy subjects; however, both methods are not interchangeable. The IMU error of measurement can be considered clinically acceptable; however, caution should be taken when this is used as a reference measure for interventions.

PMID: [32024117](#)

7. Automatic classification of gait patterns in children with cerebral palsy using fuzzy clustering method.

Darbandi H, Baniasad M, Baghdadi S, Khandan A, Vafae A, Farahmand F.

Clin Biomech (Bristol, Avon). 2020 Jan 7;73:189-194. doi: 10.1016/j.clinbiomech.2019.12.031. [Epub ahead of print]

BACKGROUND: Subjective classification of gait pattern in children with cerebral palsy depends on the assessor's experience, while mathematical methods produce virtual groups with no clinical interpretation. **METHODS:** In a retrospective study, gait data from 66 children (132 limbs) with a mean age of 9.6 (SD 3.7) years with cerebral palsy and no history of surgery or botulinum toxin injection were reviewed. The gait pattern of each limb was classified in four groups according to Rodda using three methods: 1) a team of experts subjectively assigning a gait pattern, 2) using the plantarflexor-knee extension couple index introduced by Sangeux et al., and 3) employing a fuzzy algorithm to translate the experiences of experts into objective rules and execute a clustering tool. To define fuzzy repeated-measures, 75% of the members in each group were used, and the remaining were used for validation. Eight parameters were objectively extracted from kinematic data for each group and compared using repeated measure ANOVA and post-hoc analysis was performed. Finally, the results of the clustering of the latter two methods were compared to the subjective method. **FINDINGS:** The plantarflexor-knee extension couple index achieved 86% accuracy while the fuzzy system yielded a 98% accuracy. The most substantial errors occurred between jump and apparent in both methods. **INTERPRETATION:** The presented method is a fast, reliable, and objective fuzzy clustering system to classify gait patterns in cerebral palsy, which produces clinically-relevant results. It can provide a universal common language for researchers.

PMID: [32007827](#)

8. A new tendon-lengthening technique using a tendon stripper for knee flexion contracture in a cerebral palsy patient.

Nakagawa S, Mutsuzaki H, Mataka Y, Takeuchi R, Kamada H.

J Orthop. 2019 Sep 11;18:110-112. doi: 10.1016/j.jor.2019.09.003. eCollection 2020 Mar-Apr.

Knee flexion contracture in a patient with cerebral palsy was treated by a new tendon-lengthening technique using a tendon stripper. The patient was a 10-year-old girl with mixed types of cerebral palsy related to a chromosomal anomaly. She was classified as level IV in the Gross Motor Functional Classification System with a bilateral 30° knee flexion contracture. The semitendinosus and gracilis muscle tendons were released from distal to proximal using a tendon stripper. The pulled-out muscle tendons were placed along and on their muscle portions. In addition, the semimembranosus tendon and the tendon of the biceps femoris were lengthened by an intramuscular lengthening until the contracture was released. After three weeks of casting, a long leg brace was made, and rehabilitation was started with full weight-bearing standing exercises. One year after the surgery, the improvement in maximum knee flexion contracture was maintained at 10° or less without severe progression or any complication. This new technique of using the tendon stripper on knee flexion contracture for a patient with cerebral palsy can be safe, feasible, and effective.

PMID: [32021014](#)

9. Long-Term Outcomes Following Multilevel Surgery in Cerebral Palsy.

Jones MD, Gardner R, Pyman J, Gargan MF, Witherow P, Monsell F.

J Pediatr Orthop. 2020 Jan 31. doi: 10.1097/BPO.0000000000001522. [Epub ahead of print]

BACKGROUND: This long-term consecutive, retrospective single-center cohort study evaluates long-term outcomes of single-event multilevel surgery in diplegic cerebral palsy with respect to functional status, gait, and patient satisfaction. **METHODS:** All patients with diplegic cerebral palsy who underwent single-event multilevel surgery >10 years previously were included. Retrospective gait assessment was performed using the Edinburgh Visual Gait Score (EVGS) and Gillette Functional Assessment Questionnaire Walking Scale (FAQWS) preoperatively and at midterm postoperative follow-up (median 2.6 y) and prospectively at most recent review [median 18 y, interquartile (IQ) range: 14.4 to 20.5 y]. The Short Form-36 (SF-36) was used prospectively to evaluate outcome compared with population norms for adults from the UK. **RESULTS:** The complete assessment was possible in 26 of 39 patients who met the inclusion criteria. There was a statistically significant improvement at most recent follow-up compared with the preoperative assessment for EVGS and FAQWS [Wilcoxon Matched Pairs Signed Rank test -4.42 (P<0.0001) and 3.98 (P=0.0001), respectively]. The median Physical Health and Mental Health Component Summary scores for the SF-36 were 43.0 (IQ range: 32.8 to 46.8) and 55.3 (IQ range: 46.1 to 61.1), respectively. **CONCLUSIONS:** This study demonstrates significant long-term improvements in function, independence and patient satisfaction that continue into adulthood. This will inform discussions with patients and families considering this treatment

option. LEVEL OF EVIDENCE: Level IV-Retrospective cohort study.

PMID: [32011547](#)

10. Letter to the editor on "Relationship between changes in motor capacity and objectively measured motor performance in ambulatory children with spastic cerebral palsy".

Rast FM, Labruyère R.

Child Care Health Dev. 2020 Mar;46(2):247-248. doi: 10.1111/cch.12742.

PMID: [32017230](#)

11. Validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF) as a measure of physical activity (PA) in young people with cerebral palsy: A cross-sectional study.

Lavelle G, Noorkoiv M, Theis N, Korff T, Kilbride C, Baltzopoulos V, Shortland A, Levin W, Ryan JM.

Physiotherapy. 2019 Aug 22;107:209-215. doi: 10.1016/j.physio.2019.08.013. [Epub ahead of print]

OBJECTIVES: The aim of this study was to examine the validity of the International Physical Activity Questionnaire Short Form (IPAQ-SF) as a measure of physical activity (PA) in young people with cerebral palsy (CP). **DESIGN:** Cross-sectional. **SETTING:** Participants were recruited through 8 National Health Service (NHS) trusts, one school, one university and through organisations that provide services for people with disabilities in England. **PARTICIPANTS:** Sixty-four, ambulatory young people aged 10-19 years with CP [Gross Motor Function Classification System (GMFCS) levels I-III] participated in this study. **MAIN OUTCOME MEASURE:** The IPAQ-SF was administered to participants. Participants were then asked to wear a wGT3X-BT triaxial accelerometer (ActiGraph, Pensacola, FL) for 7 days to objectively assess PA. Time spent in sedentary behaviour, in moderate to vigorous PA (MVPA) and in total PA (TPA) was compared between measures. **RESULTS:** Young people with CP self-reported less time in sedentary behaviour and underestimated the time spent in TPA, when compared to accelerometer measurements. Bland-Altman plots demonstrated poor agreement between the measures for MVPA, with upper and lower 95% limits of agreement of -147 to 148.9minute. After adjusting for gender and GMFCS level, age was a predictor of the difference between measures for MVPA ($P<0.001$) and TPA ($P<0.001$). **CONCLUSIONS:** These findings suggest that the IPAQ-SF is not a valid method of measuring TPA or sedentary behaviour in young people with CP and it is not appropriate for use when assessing an individual's time in MVPA. Therefore, where feasible, an objective measure of PA should be used. **CLINICAL TRIAL REGISTRATION NUMBER:** ISRCTN90378161.

PMID: [32026822](#)

12. Validity and Reliability of a Test Battery to Assess Change of Directions with Ball Dribbling in Para-footballers with Cerebral Palsy.

Daniel LF, Reina R, Gorla JI, Bastos T, Roldan A.

Brain Sci. 2020 Jan 31;10(2). pii: E74. doi: 10.3390/brainsci10020074.

The purpose of this study was to evaluate the content and construct validity and between-sessions reliability of four agility tests requiring ball dribbling in football players with cerebral palsy (CP) with implications for classification and training. A sample of 35 football players with CP from three different countries took part in the study. They performed four tests in two sessions 72 h apart: i) 20 m in a straight line, ii) forward slalom with short changes of direction, iii) forward slalom with wide changes of direction and iv) square course. The Kappa coefficient was used to test content validity, obtaining moderate to almost perfect agreement results. Construct validity was also demonstrated with very large to almost perfect correlations between tests and sessions. Good reliability was found using intra-class coefficients (>0.86), standard error of measurement ($<10.8\%$) and Cronbach's alpha (>0.86). The comparisons between CP profiles (i.e. sport classes) demonstrated that those with mild impairment performed faster, and those with impairment of ataxia and dyskinesia performed worse. The four tests could have applications in classification, but may also be applied by the CP football coaches to improve athlete agility and football skills.

PMID: [32023834](#)

13. Effect of cerebral palsy and dental caries on dental plaque index, salivary parameters and oxidative stress in children and adolescents.

Malta CP, Barcelos RCS, Rosa HZ, Bürger ME, Bento LW.

Eur Arch Paediatr Dent. 2020 Feb 1. doi: 10.1007/s40368-020-00509-x. [Epub ahead of print]

PURPOSE: The aim of the present study was to investigate the effect of cerebral palsy and dental caries on dental plaque index, salivary parameters and oxidative stress in children and adolescents. **METHODS:** Seventy children and adolescents aged 2-20 years were divided into four groups: neurotypical controls-inactive caries (NCIC; n = 19); neurotypical controls-active caries (NCAC; n = 16); cerebral palsy-inactive caries (CPIC; n = 19); and cerebral palsy-active caries (CPAC; n = 16). The visible dental plaque index was determined after drying the tooth surfaces and without any mechanical or chemical disclosing methods. Salivary pH and buffer capacity were measured 1 hour after collection using a digital pH meter. Saliva was used to evaluate oxidative status based on the levels of reactive species, lipid peroxidation and non-enzymatic antioxidants (reduced glutathione and vitamin C). **RESULTS:** The CPIC and CPAC groups had lower salivary pH and a higher visible dental plaque index. CP was also associated with an increase in salivary levels of markers of oxidative stress and the modulation of salivary levels of non-enzymatic antioxidants. **CONCLUSION:** Cerebral palsy exerts an influence on the salivary profile, oral health and oxidative stress. The individuals with CP had more acidic saliva and a higher dental plaque index, which were positively correlated with caries activity. CP was associated with high salivary levels of reactive species and lipid peroxidation, demonstrating an imbalance in salivary redox that was particularly associated with caries activity. These factors facilitate the development of oral diseases in individuals with cerebral palsy. **KEYWORDS:** Antioxidant defense system; Cerebral palsy; Lipid peroxidation; Reactive species; Saliva

PMID: [32008171](#)

14. Percutaneous endoscopic gastrostomy in children less than 10 kilograms: A comparative study.

Bawazir OA.

Saudi J Gastroenterol. 2020 Feb 7. doi: 10.4103/sjg.SJG_525_19. [Epub ahead of print]

BACKGROUND/AIM: Percutaneous endoscopic gastrostomy tube (PEG) has replaced the standard open surgical gastrostomy for enteral nutrition. However, several complications were reported, especially in children less than 10 kg. Our objective was to report the outcomes of percutaneous endoscopic gastrostomy in children according to their weight. **PATIENTS AND METHODS:** 163 children had PEG tube insertion in our tertiary referral hospital from January 2007 to March 2019. Patients were divided into two groups according to the weight; group I (less than 10 kg; n = 112) and group II (more than 10 kg; n = 51). Comparisons were made between the two groups for incidence of postoperative complications, the need for reintervention, 30-day, and 1-year mortality. **RESULTS:** There were 51 males (45.5%) in group I and 27 in group II (52.9%) (P = 0.38). The mean weight at the time of endoscopy was 5.9 ± 1.53 and 17.3 ± 8.23 kg and the mean American Society of Anesthesiologists (ASA) score was 2.6 ± 0.67 and 2.43 ± 0.57 in group I and II, respectively (P = 0.101). The most common associated condition was cerebral palsy (50 (44.6%) and 24 (47.1%) in group I and II, respectively; P = 0.77). The mean operative time was 30.28 ± 11.57 min in group I and 33.62 ± 23.36 min in group II (P = 0.221). Skin complications were the most commonly encountered complications of PEG, and 49% (n = 48) required the removal and replacement of the tube under general anesthesia in group I and 41% (n = 21) in group II (P = 0.84). There was no significant difference in the complication between groups. **CONCLUSION:** PEG is a safe technique in children less than 10 kg, and the complications rate is comparable with older children. The use of positive transillumination and small needle for measuring the distance between the skin and the stomach enhances the safety of the procedure. PEG should be considered in children less than 10 kg who need supportive or continuous enteral nutrition for different reasons.

PMID: [32031162](#)

15. Exploration of the Influential Factors on Adherence to Occupational Therapy in Parents of Children with Cerebral

Palsy: A Qualitative Study.

Rezaie L, Kendi S.

Patient Prefer Adherence. 2020 Jan 13;14:63-72. doi: 10.2147/PPA.S229535. eCollection 2020.

BACKGROUND: Cerebral palsy (CP) is the leading cause of permanent disability in children. Occupational therapists serve a primary role in the rehabilitation of children with CP. Poor adherence to treatment is common. The aim of this study is to explore the viewpoint of occupational therapists on factors which impact adherence to occupational therapy (OT) interventions among parents of children with CP. **MATERIAL AND METHODS:** A qualitative approach using semi-structured interviews were employed. Our participants were recruited by purposive sampling among occupational therapists who were working in Kermanshah province, western Iran. The interviews were taped and transcribed. Content analysis using constant comparison was performed. **RESULTS:** The mean age of our participants was 34.23 ± 7.50 . Four main categories with specific subcategories emerged as important in affecting adherence. The first category of child and family-related factors described factors such as the clinical status of the child and family composition. These factors had the potential for both improving and reducing adherence to treatment. The second category of therapist-related factors described the effect of appropriate professional skills of the therapist on improving adherence and included clinical competency, communication skills, and job satisfaction. The third category of environmental factors addressed factors such as cultural views of child disability and access to OT interventions. The category mostly emphasized environmental barriers to adherence to treatment. The fourth category of therapy-related factors described barriers such as the type of therapy, and the length of treatment. **CONCLUSION:** Adherence to OT interventions in parents of children with CP can be influenced by several factors. These factors range from child and family-related factors to therapy-related factors and have the potential for both positively and negatively affecting adherence. Programs to improve adherence should address these factors together.

PMID: [32021118](#)**16. Cognitive functioning in children with cerebral palsy.**

Stadskeiv K

Dev Med Child Neurol. 2020 Mar;62(3):283-289. doi: 10.1111/dmcn.14463. Epub 2020 Jan 9.

Children with cerebral palsy (CP) have an increased risk of cognitive impairments. This narrative review of the literature discusses assessment of cognition in children with CP, presents the most salient characteristics of cognitive functioning pertaining to each subtype, and discusses the relationships between brain injury, functioning, and intervention from a developmental perspective. A search for original studies of cognitive functioning in children with different subtypes of CP was performed. The search resulted in 81 unique hits. There were few studies with a representative sample of children with CP where all participants were individually assessed. Cognitive functioning in children with the most severe motor impairments were often assumed and not assessed. Furthermore, there was a confounding of IQ below 70 and intellectual disability, possibly leading to an overestimation of the prevalence of intellectual disability. Longitudinal neuropsychological studies, including also very young children and those with the most severe speech and motor impairments, as well as intervention studies, are called for. **WHAT THIS PAPER ADDS:** Few studies have assessed cognition in a representative sample of children with cerebral palsy. Cognition in children with severe motor impairment is often assumed, not assessed. Lack of assessment may lead to overestimating the prevalence of intellectual disability. Lowered cognitive functioning in older children highlights the need for longitudinal studies.

PMID: [32010976](#)**17. Short-term and long-term outcomes of very-low-birth-weight infants in Korea: Korean Neonatal Network update in 2019.**

Lee JH, Youn Y, Chang YS.

Clin Exp Pediatr. 2020 Feb 5. doi: 10.3345/cep.2019.00822. [Epub ahead of print]

Korea has encountered the lowest birth rate in the world and the rapid increase in the number of preterm infants. The Korean Neonatal Network (KNN), launched by the Korean Society of Neonatology under the support of Korean Center for Disease

Control collects population-based data for very-low-birth-weight infants (VLBWIs) born in Korea since 2013. In terms of the short-term outcomes of VLBWIs born from 2013 to 2016 registered in the KNN, the survival rate of all VLBWIs was 86%. Respiratory distress syndrome and bronchopulmonary dysplasia were observed in 78% and 30% of all VLBWIs, respectively. Necrotizing enterocolitis was found in 7%, and 8% of the VLBWIs needed therapy for retinopathy of prematurity (ROP) in the neonatal intensive care unit (NICU). Sepsis occurred in 21% during their NICU stay. Intraventricular hemorrhage (\geq grade III) was diagnosed in 10%. In terms of the long-term outcomes for VLBWIs born from 2013 to 2014 registered in the KNN, the post-discharge mortality was approximately 1.2-1.5% mainly owing to their underlying illness. Nearly half of the VLBWIs were readmitted to the hospital at least once in their first 1-2 years of life mostly as a result of respiratory diseases. The overall prevalence of cerebral palsy was 6.2-6.6% in Korea. Blindness in both eyes was reported in 0.2-0.3% of VLBWIs. Bilateral hearing loss was found in 0.8-1.9%. Since its establishment, the KNN has been publishing annual reports and papers that facilitate improvement of outcomes of VLBWIs and formulation of essential healthcare policies in Korea.

PMID: [32023404](#)

18. Risk Factors of Birth Asphyxia Among Neonates Born in Public Hospitals of Tigray, Northern Ethiopia.

Berhe YZ, Kebedom AG, Gebregziabher L, Assefa NE, Berhe LZ, Mohammednur SA, Wellay T, Berihu G, Welearegay AT, Mitiku M, Teka HG.

Pediatric Health Med Ther. 2020 Jan 8;11:13-20. doi: 10.2147/PHMT.S231290. eCollection 2020.

INTRODUCTION: Birth asphyxia is defined by the World Health Organization as not initiating and maintaining default breathing at birth. Approximately 24% of neonatal deaths occurred annually worldwide due to birth asphyxia. About 3% of the 120 million neonates born each year acquire asphyxia in third world countries. Long-term survivors may experience cerebral palsy, delay in growth, vision, hearing and intellectual deficiency, epilepsy, difficulties with communication and behavior. Thus, this study aims to determine the risk factors of birth asphyxia among neonates who were delivered at public hospitals of Tigray, Ethiopia. **MATERIALS AND METHODS:** Hospital-based unmatched case-control study design was implemented on 390 samples from January to February 2018. Data were collected by interviews using a structured questionnaire and checklist. The collected data were coded and entered using EpiData version 3.1 statistical software and transported to statistical package for social science (SPSS) version 20 software for analysis. Cross-tabulation and odds ratio with 95% confidence interval were computed. Bivariate logistic regression and multivariable logistic regression were done. Multicollinearity was checked. Goodness of fit was checked by the Hosmer-Lemeshow test. **RESULTS:** A total of 260 controls and 130 cases were enrolled in the study. Multivariable logistic regression showed that Primi-parity [AOR 5.5 (CI: 2.5, 12.3)], pre-eclampsia/pregnancy-induced hypertension [AOR 12.4 (CI: 4.17, 37.15)], post-term pregnancy [AOR 2.73 (CI: 1.00, 7.55)] meconium-stained liquor [AOR 29.2 (CI: 12.0, 71.1)], cord entangled [AOR 5.67 (CI: 1.66, 19.3)] and non-vertex presentation [AOR 5.49 (CI: 2.20, 13.7)] were found to be risk factors for perinatal birth asphyxia. **CONCLUSION AND RECOMMENDATIONS:** Intrapartum factors and neonatal factors in the index pregnancy have an association with perinatal birth asphyxia. The research finding suggests effective antenatal care follow-up and follow-up of labor progress using partograph after labor initiation.

PMID: [32021551](#)

19. Low Apgar score in term newborns and long-term infectious morbidity: a population-based cohort study with up to 18 years of follow-up.

Gutbir Y, Wainstock T, Sheiner E, Segal I, Sergienko R, Landau D, Walfisch A.

Eur J Pediatr. 2020 Feb 3. doi: 10.1007/s00431-020-03593-9. [Epub ahead of print]

Since introduced, the Apgar score has remained the most widespread predictor for neonatal morbidity and mortality. We aimed to investigate the association between low 5-min Apgar score and long-term infectious pediatric morbidity. A population-based cohort analysis was performed comparing total and specific subtypes of infectious morbidity leading to hospitalization among term newborns with normal (≥ 7) and low (< 7) 5-min Apgar scores, born between 1999 and 2014 at a single tertiary regional hospital. Infectious morbidity included hospitalizations involving a pre-defined set of infection-related ICD-9 codes. A Kaplan-Meier survival curve was constructed to compare cumulative infectious morbidity incidence and a Cox proportional hazards model to adjust for confounders. The long-term analysis of 223,335 children (excluding perinatal death cases) yielded 585 (0.3%) infants with low 5-min Apgar scores. The rate of infection-related hospitalizations was 9.8% and 12.4% among newborns with normal and low 5-min Apgar scores, respectively ($p = 0.06$). Adjusting for maternal age, gestational age, hypertension, diabetes, cesarean delivery, and fertility treatments, the association proved to be statistically significant (adjusted

HR = 1.28; 95% CI 1.01-1.61). Conclusion: Term infants with low 5-min Apgar scores may be at an increased risk for long-term pediatric infectious morbidity. What is Known: • Though not meant to be a prognostic tool for long-term morbidity, studies assessing the correlation between low Apgar score and long-term outcomes were and are being performed, reporting significant associations with many outcomes—such as cerebral palsy (CP), ophthalmic disorders, GI disorders, and several types of malignancies. • Yet, an association between low Apgar scores and future health remains a matter of controversy. What is New: • Our work shows that a low 5-min Apgar score is independently associated with long-term pediatric infection-related hospitalizations among term singleton newborns.

PMID: [32016603](#)

20. Prelabor rupture of membranes and the association with cerebral palsy in term born children: a national registry-based cohort study.

Mynarek M, Bjellmo S, Lydersen S, Strand KM, Afset JE, Andersen GL, Vik T.

BMC Pregnancy Childbirth. 2020 Jan 31;20(1):67. doi: 10.1186/s12884-020-2751-3.

BACKGROUND: Guidelines regarding management of prelabor rupture of membranes (PROM) at term vary between immediate induction and expectant management. A long interval between PROM and delivery increases the risk for perinatal infections. Severe perinatal infections are associated with excess risk for cerebral palsy (CP) and perinatal death. We investigated if increasing intervals between PROM and delivery were associated with perinatal death or CP. **METHODS:** Eligible to participate in this population-based cohort-study were term born singletons without congenital malformations born in Norway during 1999-2009. Data was retrieved from the Medical Birth Registry of Norway (MBRN) and the Cerebral Palsy Register of Norway. In line with the registration in the MBRN, intervals between PROM and delivery of more than 24 h was defined as 'prolonged' and intervals between 12 and 24 h as 'intermediate'. Outcomes were stillbirth, death during delivery, neonatal mortality and CP. Logistic regression was used to calculate odds ratio (OR) with 95% confidence intervals (CI) for adverse outcomes in children born after prolonged and intermediate intervals, compared with a reference group comprising all children born less than 12 h after PROM or without PROM. **RESULTS:** Among 559,972 births, 34,759 children were born after intermediate and 30,332 were born after prolonged intervals. There was no association between increasing intervals and death during delivery or in the neonatal period, while the prevalence of stillbirths decreased with increasing intervals. Among children born after intermediate intervals 38 (0.11%) had CP, while among those born after prolonged intervals 46 (0.15%) had CP. Compared with the reference group, the OR for CP was 1.16 (CI; 0.83 to 1.61) after intermediate and 1.61 (CI; 1.19 to 2.18) after prolonged intervals. Adjusting for antenatal factors did not affect these associations. Among children with CP the proportion with diffuse cortical injury and basal ganglia pathology on cerebral MRI, consistent with hypoxic-ischemic injuries, increased with increasing intervals. **CONCLUSION:** Intervals between PROM and delivery of more than 24 h were associated with CP, but not with neonatal mortality or death during delivery. The inverse association with stillbirth is probably due to reverse causality.

PMID: [32005186](#)

21. Prenatal findings, neonatal symptoms and neurodevelopmental outcome of congenital cytomegalovirus infection in a university hospital in Montreal, Quebec.

Minsart AF, Rypens F, Smiljkovic M, Kakkar F, Renaud C, Lamarre V, Boucher M, Boucoiran I.

J Perinat Med. 2020 Feb 6. pii: /j/jpme.ahead-of-print/jpm-2019-0331/jpm-2019-0331.xml. doi: 10.1515/jpm-2019-0331. [Epub ahead of print]

Background Outcome of congenital cytomegalovirus (cCMV) infection in the absence of routine CMV screening and third-trimester scan in North America is scarcely documented. The aim of this study was to assess the severe outcomes related to cCMV according to the indication for screening. **Methods** This was a retrospective study of 84 mother-child pairs followed for cCMV between 2003 and 2017 at CHU Sainte-Justine in Montreal, Canada. Prenatal ultrasound, neonatal symptoms, neuroimaging and severe outcomes (cerebral palsy, severe cognitive impairment, bilateral hearing loss or neonatal death) were reviewed. **Results** Among 38 cases with abnormal prenatal ultrasound, 41.9% of live-born infants developed severe outcomes. Sixteen (42.1%) were detected in the third trimester. Among 16 cases diagnosed prenatally because of maternal history, all had normal prenatal ultrasound, and none developed severe outcomes. Among cases diagnosed postnatally because of neonatal symptoms, 25% developed severe outcomes. All infants who developed severe outcomes had moderate/severe neonatal symptoms. **Conclusion** Outcome of cCMV infection varies according to the reason for screening and timing of diagnosis. Any

prenatal ultrasound anomaly might indicate a risk of severe outcome, and warrants a detailed ultrasound scan. However, late detection, or postnatal diagnosis, represented more than half of the cases, and awareness of this will help ensuring optimal management.

PMID: [32031981](#)

22. [Late preterm : high risk newborns despite appearances]. [Article in French; Abstract available in French from the publisher]

Snyers D, Lefebvre C, Viellevoye R, Rigo V.

Rev Med Liege. 2020 Feb;75(2):105-110.

Late preterm infants are born between 34 weeks of amenorrhea and 36 weeks 6 days. Late preterms represent the largest proportion of premature infants (about 75 %). Late prematurity is increasing in recent decades. While studies initially focused on mortality and morbidity related to very preterm birth, the late preterms have been the subject of increased attention over the past 15 years. Late preterm infants have an increased risk of respiratory complications, infections, feeding problems, hypothermia and hypoglycemia. Neonatal, infant and during adulthood mortalities are significantly higher in late preterm than in term infants. In addition, late preterm infants carry an increased risk of long-term morbidities, such as neurodevelopmental delay, cerebral palsy, chronic respiratory or metabolic diseases. This review highlights the evidence that late preterm infants are high risk newborns and require adapted follow-up.

PMID: [32030935](#)

23. Changes in Mortality and Cerebral Palsy in Extremely Low-Birth-Weight Infants in a Tertiary Center in Hong Kong.

Chee YY, Wong RMS, Wong MSC, Tso WWY, Wong WHS, Lee SL.

Glob Pediatr Health. 2020 Jan 22;7:2333794X20901932. doi: 10.1177/2333794X20901932. eCollection 2020.

Introduction. We retrospectively reviewed a cohort of extremely low-birth-weight (ELBW) babies born at Queen Mary Hospital and explored if there is any time trend in survival and short-term neurodevelopmental outcomes. **Methods.** We included ELBW infants born at Queen Mary Hospital between 2008 and 2015. The relationships between multiple risk factors with survival and neurodevelopmental outcomes were analyzed by either Cox regression or univariate logistic regression analysis. We also compared this birth-year period with our previous study from 1993 to 2002. **Results.** Two hundred seventeen ELBW infants were delivered during the study period. There was significantly higher overall survival rate (81.1%) in 2008 to 2015 compared with 71.4% in 1993 to 2002. One hundred forty-three out of 176 (81%) survivors were assessed at a corrected mean age of 18.1 months. A total of 4.2% had cerebral palsy. There were significantly lower rates of cerebral palsy in 2008 to 2015 (4.2%) compared with 1993 to 2002 (13.5%). **Conclusions.** We showed a temporal improvement in survival and short-term neurodevelopmental outcomes.

PMID: [32030351](#)

24. Are boys and girls just different? Gender differences in the Movement Assessment Battery for Children, 2nd edition (M ABC-2) suggests that they are.

Fairbairn N, Galea C, Wallen M, Walker K, Hodge A, Badawi N, Loughran-Fowlds A.

Aust Occup Ther J. 2020 Feb 6. doi: 10.1111/1440-1630.12646. [Epub ahead of print]

INTRODUCTION: The second edition of the Movement Assessment Battery for Children (M ABC-2) is a standardised, norm referenced assessment that is frequently used by therapists to identify children with motor difficulties. The norms for the M ABC-2 were derived from a sample of children in the United Kingdom (UK) and are combined across the age groups for boys and girls. The aims of this research were to investigate gender differences in the performance of 8- and 9-year-old Australian

children and if the norms in our cohort differed from UK-based M ABC-2 norms. **METHODS:** Children aged 8 or 9 years of age who underwent major neonatal cardiac or non-cardiac surgery and healthy controls were assessed using the M ABC-2 as part of the Development After Infant Surgery (DAISy) study. **RESULTS:** There were statistically significant differences in the scores for boys and girls aged 8- and 9-years old on the M ABC-2. Girls performed better than boys in manual dexterity and on total standard scores. Our control group compared to the assessment norms scored significantly poorer in manual dexterity, aiming and catching and total standard scores. **CONCLUSION:** Caution should be used when interpreting the results of the M ABC-2 for Australian 8- and 9-year olds. Contemporary Australian, gender-specific M ABC-2 norms should be considered. Further research is required to investigate gender differences and differences in performance of Australian children compared to the assessment norms in other age groups on the M ABC-2.

PMID: [32030778](#)

25. Increasing Mothers' Confidence and Ability by Creating Opportunities for Parent Empowerment (COPE): A Randomized, Controlled Trial.

Askary Kachoosangy R, Shafaroodi N, Heidarzadeh M, Qorbani M, Bordbbr A, Hejazi Shirmard M, Daneshjoo F.

Iran J Child Neurol. 2020 Winter;14(1):77-83.

OBJECTIVES: Premature neonates are at great risk for cerebral palsy, developmental delays, hearing problems and visual impairments. Interventions to reduce the morbidities and adverse health outcomes in these neonates and improve parent-infant interaction are highly important. This study was conducted to determine the effect of the Creating Opportunities for Parent Empowerment (COPE) program on the perceived maternal parenting self-efficacy of premature parents. **MATERIALS & METHODS:** This was a randomized controlled trial with equal randomization (1:1:1 for 3 groups) and parallel group design. Forty-five preterm neonates were randomly allocated to treatment (n=15), supervision (n=15) and control (n=15) groups. COPE program was provided in the form of a 4-phase educational-behavioral intervention to the treatment and supervision groups. The primary outcome was parental self-efficacy, which was assessed by the Perceived Maternal Parenting Self-Efficacy inventory. All the measurements were performed pre- and post-completion with the valid equipment and by blind assessors. **RESULTS:** COPE mothers reported significantly stronger beliefs regarding their parental role and have more confidence to their ability in caring of neonates compared with control mothers (P-value <0.001). **CONCLUSION:** An educational-behavioral intervention would strengthen mothers' belief in themselves and knowledge about their neonates and would enhance premature mothers' ability to care for their neonates as well as parent-infant interaction.

PMID: [32021631](#)

26. Activity Limitation in Children with Cerebral Palsy and Parenting Stress, Depression, and Self-esteem: A Structural Equation Model.

Park EY, Kim JH.

Pediatr Int. 2020 Feb 3. doi: 10.1111/ped.14177. [Epub ahead of print]

BACKGROUND: The challenges associated with the activity limitation and participation constraints of children with cerebral palsy may increase their parents' stress. The present study aims to identify the factors associated with parenting stress in mothers of children with cerebral palsy (CP) and to test the multidimensional assumptions of the condition, focusing on the relationship between stress, self-esteem, and depression among parents and the activity limitation of their children. **METHODS:** We used structural equation modeling (SEM) to examine the relationships between activity limitation (gross and fine motor, and communication function) in children with CP and their mothers' depression, self-esteem, and parenting stress. The participants were 217 children with CP (123 boys; 94 girls). The mean age of the children involved in the study was 6.61 (SD = 2.76). The types of CP were spastic (71.0%), dyskinetic/athetotic (7.8%), ataxic (4.6%), and mixed (5.5%). We further used SEM to investigate the mediating influence of depression and self-esteem on parent-child relationships, as well as the direct effects on parenting stress. **RESULTS:** The proposed model showed excellent fit indices. Activity limitation had an indirect effect and depression had a direct effect on self-esteem. Activity limitation and depression had effects on parenting stress both directly and indirectly, while self-esteem had only a direct effect on parenting stress. **CONCLUSIONS:** The results highlight the importance of identifying parental depression and self-esteem as predictive variables for parenting stress among parents of children with CP, as well as children's activity limitation.

PMID: [32009273](#)

27. Bilirubin Induced Encephalopathy.

Karimzadeh P, Fallahi M, Kazemian M, Taslimi Taleghani N, Nouripour S, Radfar M.

Iran J Child Neurol. 2020 Winter;14(1):7-19.

Hyperbilirubinemia is one of the most common neonatal disorders. Delayed diagnosis and treatment of the pathologic and progressive indirect hyperbilirubinemia lead to neurological deficits, defined as bilirubin induced encephalopathy (BIE) (2). The incidence of this disorder in underdeveloped countries is much more than developed areas. All neonates with the risk factors for increased the blood level of indirect bilirubin are at risk for BIE, especially preterm neonates which are prone to low bilirubin kernicterus . BIE can be transient and acute (with early, intermediate and advanced phases) or be permanent, chronic and lifelong (with tetrad of symptoms including visual (upward gaze palsy), auditory (sensory neural hearing loss), dental dysplasia abnormalities, and extrapyramidal disturbances (choreoathetosis cerebral palsy). Beside the abnormal neurologic manifestations of the jaundiced neonates ,brain MRI is the best imaging modality for the confirmation of the diagnosis. Although early treatment of extreme hyperbilirubinemia by phototherapy and exchange transfusion can prevent the BIE, unfortunately the chronic bilirubin encephalopathy does not have definitive treatment.

PMID: [32021624](#)

28. Neurologic outcomes of the premature lamb in an extrauterine environment for neonatal development.

McGovern PE, Hornick MA, Mejaddam AY, Lawrence K, Schupper AJ, Rossidis AC, Baumgarten H, Vossough A, Didier RA, Kim A, Partridge EA, Hwang G, Young K, Peranteau WH, Davey MG, Flake AW.

J Pediatr Surg. 2020 Jan 8. pii: S0022-3468(19)30936-4. doi: 10.1016/j.jpedsurg.2019.12.026. [Epub ahead of print]

BACKGROUND/PURPOSE: Neurologic injury remains the most important morbidity of prematurity. Those born at the earliest gestational ages can face a lifetime of major disability. Perinatal insults result in developmental delay, cerebral palsy, and other profound permanent neurologic impairments. The EXTracorporeal Environment for Neonatal Development (EXTEND) aims to transition premature neonates through this sensitive period, but it's impact on neurologic development requires analysis. **METHODS:** Fetal sheep were maintained in a fluid-filled environment for up to 28 days. Physiologic parameters were measured continuously; tissues were subsequently fixed and preserved for myelin quantification, glial cell staining, and structural assessment via magnetic resonance. Surviving animals were functionally assessed. **RESULTS:** No evidence of fetal brain ischemia or white matter tract injury associated with the EXTEND system was detected, and the degree of myelination was regionally appropriate and consistent with age matched controls. No evidence of neurologic injury or immaturity was visible on magnetic resonance; animals that transitioned from the system had no persistent neurologic deficits. **CONCLUSIONS:** No evidence of major neurologic morbidity was found in animals supported on the EXTEND system, though more work needs to be done in order to verify its safety during critical periods of neurologic development.

PMID: [32014247](#)

29. How useful is the diagnosis of ataxic cerebral palsy?

Dan B.

Dev Med Child Neurol. 2020 Mar;62(3):264. doi: 10.1111/dmen.14453.

PMID: [32010973](#)

30. Does a Reduced Number of Muscle Stem Cells Impair the Addition of Sarcomeres and Recovery from a Skeletal Muscle Contracture? A Transgenic Mouse Model.

Dayanidhi S, Kinney MC, Dykstra PB, Lieber RL.

Clin Orthop Relat Res. 2020 Jan 29. doi: 10.1097/CORR.0000000000001134. [Epub ahead of print]

BACKGROUND: Children with cerebral palsy have impaired muscle growth and muscular contractures that limit their ROM. Contractures have a decreased number of serial sarcomeres and overstretched lengths, suggesting an association with a reduced ability to add the serial sarcomeres required for normal postnatal growth. Contractures also show a markedly reduced number of satellite cells—the muscle stem cells that are indispensable for postnatal muscle growth, repair, and regeneration. The potential role of the reduced number of muscle stem cells in impaired sarcomere addition leading to contractures must be evaluated. **QUESTIONS/PURPOSES:** (1) Does a reduced satellite cell number impair the addition of serial sarcomeres during recovery from an immobilization-induced contracture? (2) Is the severity of contracture due to the decreased number of serial sarcomeres or increased collagen content? **METHODS:** The hindlimbs of satellite cell-specific Cre-inducible mice (Pax7; Rosa26; n = 10) were maintained in plantarflexion with plaster casts for 2 weeks so that the soleus was chronically shortened and the number of its serial sarcomeres was reduced by approximately 20%. Subsequently, mice were treated with either tamoxifen to reduce the number of satellite cells or a vehicle (an injection and handling control). The transgenic mouse model with satellite cell ablation combined with a casting model to reduce serial sarcomere number recreates two features observed in muscular contractures in children with cerebral palsy. After 30 days, the casts were removed, the mice ankles were in plantarflexion, and the mice's ability to recover its ankle ROM by cage remobilization for 30 days were evaluated. We quantified the number of serial sarcomeres, myofiber area, and collagen content of the soleus muscle as well as maximal ankle dorsiflexion at the end of the recovery period. **RESULTS:** Mice with reduced satellite cell numbers did not regain normal ankle ROM in dorsiflexion; that is, the muscles remained in plantarflexion contracture ($-16^\circ \pm 13^\circ$ versus $31^\circ \pm 39^\circ$ for the control group, -47 [95% CI -89 to -5]; $p = 0.0322$). Serial sarcomere number of the soleus was lower on the casted side than the contralateral side of the mice with a reduced number of satellite cells (2214 ± 333 versus 2543 ± 206 , -329 [95% CI -650 to -9]; $p = 0.044$) but not different in the control group (2644 ± 194 versus 2729 ± 249 , -85 [95% CI -406 to 236]; $p = 0.9737$). The degree of contracture was strongly associated with the number of sarcomeres and myofiber area ($r = 0.80$; $p = 0.0077$) rather than collagen content. No differences were seen between groups in terms of collagen content and the fraction of muscle area. **CONCLUSIONS:** We found that a reduced number of muscle stem cells in a transgenic mouse model impaired the muscle's ability to add sarcomeres in series and thus to recover from an immobilization-induced contracture. **CLINICAL RELEVANCE:** The results of our study in transgenic mouse muscle suggests there may be a mechanistic relationship between a reduced number of satellite cells and a reduced number of serial sarcomeres. Contracture development, secondary to impaired sarcomere addition in muscles in children with cerebral palsy may be due to a reduced number of muscle stem cells.

PMID: [32011372](#)

Prevention and Cure

31. Therapeutic evidence of umbilical cord-derived mesenchymal stem cell transplantation for cerebral palsy: a randomized, controlled trial.

Gu J, Huang L, Zhang C, Wang Y, Zhang R, Tu Z, Wang H, Zhou X, Xiao Z, Liu Z, Hu X, Ke Z, Wang D, Liu L.

Stem Cell Res Ther. 2020 Feb 3;11(1):43. doi: 10.1186/s13287-019-1545-x.

BACKGROUND: Cerebral palsy (CP) is a syndrome of childhood movement and posture disorders. Clinical evidence is still limited and sometimes inconclusive about the benefits of human umbilical cord mesenchymal stem cells (hUC-MSCs) for CP. We conducted a randomized trial to evaluate the safety and efficacy of hUC-MSC transplantation concomitant with rehabilitation in patients with CP. **METHODS:** Eligible patients were allocated into the hUC-MSC group and control group. In addition to rehabilitation, the patients in the hUC-MSC group received four transfusions of hUC-MSCs intravenously, while the control group received a placebo. Adverse events (AEs) were collected for safety evaluation in the 12-month follow-up phase. Primary endpoints were assessed as activities of daily living (ADL), comprehensive function assessment (CFA), and gross motor function measure (GMFM) scales. In addition, cerebral metabolic activity was detected by ^{18}F -FDG-PET/CT to explore the possible mechanism of the therapeutic effects. Primary endpoint data were analyzed by ANOVA using SPSS version 20.0. **RESULTS:** Forty patients were enrolled, and 1 patient withdrew informed consent. Therefore, 39 patients

received treatments and completed the scheduled assessments. No significant difference was shown between the 2 groups in AE incidence. Additionally, significant improvements in ADL, CFA, and GMFM were observed in the hUC-MSK group compared with the control group. In addition, the standard uptake value of ¹⁸F-FDG was markedly increased in 3 out of 5 patients from the hUC-MSK group at 12 months after transplantation. CONCLUSIONS: Our clinical data showed that hUC-MSK transplantation was safe and effective at improving the gross motor and comprehensive function of children with CP when combined with rehabilitation. Recovery of cerebral metabolic activity might play an essential role in the improvements in brain function in patients with CP. The therapeutic window, transfusion route, and dosage in our study were considerable for reference in clinical application. TRIAL REGISTRATION: Chict.org.cn, ChiCTR1800016554. Registered 08 June 2018-retrospectively registered. The public title was "Randomized trial of umbilical cord-derived mesenchymal stem cells for cerebral palsy."

PMID: [32014055](#)

32. Dense hydroxyl polyethylene glycol dendrimer targets activated glia in multiple CNS disorders.

Sharma A, Sharma R, Zhang Z, Liaw K, Kambhampati SP, Porterfield JE, Lin KC, DeRidder LB, Kannan S, Kannan RM.

Sci Adv. 2020 Jan 22;6(4):eaay8514. doi: 10.1126/sciadv.aay8514. eCollection 2020 Jan.

Poor transport of neuropharmaceutics through central nervous system (CNS) barriers limits the development of effective treatments for CNS disorders. We present the facile synthesis of a novel neuroinflammation-targeting polyethylene glycol-based dendrimer (PEGOL-60) using an efficient click chemistry approach. PEGOL-60 reduces synthetic burden by achieving high hydroxyl surface density at low generation, which plays a key role in brain penetration and glia targeting of dendrimers in CNS disorders. Systemically administered PEGOL-60 crosses impaired CNS barriers and specifically targets activated microglia/macrophages at the injured site in diverse animal models for cerebral palsy, glioblastoma, and age-related macular degeneration, demonstrating its potential to overcome impaired blood-brain, blood-tumor-brain, and blood-retinal barriers and target key cells in the CNS. PEGOL-60 also exhibits powerful intrinsic anti-oxidant and anti-inflammatory effects in inflamed microglia in vitro. Therefore, PEGOL-60 is an effective vehicle to specifically deliver therapies to sites of CNS injury for enhanced therapeutic outcomes in a range of neuroinflammatory diseases.

PMID: [32010790](#)