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Interventions and Management

1. Motor performance of children with cerebral palsy in anterior reach.

Soares LMDS, Rozane JMSG, Carvalho RP.

Clin Biomech (Bristol, Avon). 2019 Jun 11;68:158-162. doi: 10.1016/j.clinbiomech.2019.06.007. [Epub ahead of print]

BACKGROUND: Children with cerebral palsy perform small displacements during the anterior reach movement from standing position without loss of balance. There are two possible reasons for their decreased performance: the difficulty to stabilize their lower limbs during forward body inclination to reach greater distances or to control the movement of forward reaching. The objective of this study is to identify and compare the motor performance of children with CP and typically developing children, during anterior reach.**METHODS:** This is a cross-sectional study, composed of 28 children, 14 with spastic cerebral palsy and 14 typical children, who were all evaluated by the Pediatric Reach Test and three-dimensional motion analysis.**FINDINGS:** The decreased performance was shown by the lower movement control by children with cerebral palsy. The bilateral and unilateral cerebral palsy children showed lower range of motion of shoulder and trunk than typical children.**INTERPRETATION:** Children with cerebral palsy show lower anterior displacement and movement control and difficulty bending the trunk and flexing shoulders while reaching forward, suggesting poor postural balance.

PMID: [31212211](#)

2. Primary surgery to prevent hip dislocation in children with cerebral palsy in Sweden: a minimum 5-year follow-up by the national surveillance program (CPUP).

Kiapekos N, Broström E, Hägglund G, Åstrand P.

Acta Orthop. 2019 Jun 18:1-10. doi: 10.1080/17453674.2019.1627116. [Epub ahead of print]

Background and purpose - Children with cerebral palsy (CP) have an increased risk of hip dislocation. Outcome studies after surgery to prevent hip dislocation in children with CP are usually retrospective series from single tertiary referral centers. According to the national CP surveillance program in Sweden (CPUP), hip surgery should preferably be performed at an early age to prevent hip dislocation. Preventive operations are performed in 12 different Swedish hospitals. We compared the outcomes between soft tissue release and femoral osteotomy in children with CP treated in these hospitals. **Patients and methods** - 186 children with CP underwent either adductor-iliopsoas tenotomy (APT) or femoral osteotomy (FO) as the primary, preventive surgery because of hip displacement. They were followed for a minimum of 5 years (mean 8 years) regarding revision surgery and hip migration. A good outcome was defined as the absence of revision surgery and a migration percentage (MP) < 50% at the latest follow-up. Logistic and Cox regression analysis were used to investigate the influence of age, sex, preoperative MP, Gross Motor Function Classification System (GMFCS) level, and CP subtype. **Results** - APT was performed in 129 (69%) children. After 5 years, the reoperation rate was 43%, and 2 children (2%) had an MP > 50%. For the 57 children who underwent FO, the corresponding figures were 39% and 9%. Of the potential risk factors studied, the outcome was statistically significantly associated with preoperative MP only in children who underwent APT, but not in those who underwent FO. None of the other factors were significantly associated with the outcome in the 2 procedure groups. **Interpretation** - Reoperation rates after preventive surgery are high and indicate the importance of continued postoperative follow-up. Age, sex, GMFCS level, and CP subtype did not influence the outcome significantly.

PMID: [31210072](#)

3. The Appendicular Lean Mass Index Is a Suitable Surrogate for Muscle Mass in Children with Cerebral Palsy.

Duran I, Martakis K, Rehberg M, Stark C, Koy A, Schoenau E.

J Nutr. 2019 Jun 17. pii: nxz127. doi: 10.1093/jn/nxz127. [Epub ahead of print]

BACKGROUND: Densitometrically measured lean body mass (LBM) is often used to quantify skeletal muscle mass in children with cerebral palsy (CP). Since LBM depends on the individual's height, the evaluation of $\frac{\text{LBM}}{\text{height}^2}$ (lean BMI) is often recommended. However, LBM includes not only skeletal muscle mass but also the mass of skin, internal organs, tendons, and other components. This limitation applies to a far lesser extent to the appendicular lean mass index (LMI_{app}). **OBJECTIVES:** The aim of the study was to evaluate skeletal muscle mass in children with CP using total lean BMI (LMI_{tot}) and LMI_{app}. **METHODS:** The present study was a monocentric retrospective analysis of prospectively collected data among children and adolescents with CP participating in a rehabilitation program. In total, 329 children with CP [148 females; Gross Motor Function Classification Scale (GMFCS) I, 32 children; GMFCS II, 73 children; GMFCS III, 133 children; GMFCS IV, 78 children; and GMFCS V, 13 children] were eligible for analysis. The mean age was 12.3 ± 2.75 y. Pediatric reference centiles for age-adjusted LMI_{app} were generated using data from NHANES 1999-2004. Low skeletal muscle mass was defined as a z score for DXA determined LMI_{tot} and LMI_{app} less than or equal to -2.0. **RESULTS:** The z scores for LMI_{app} were significantly lower than LMI_{tot} in children with CP, GMFCS levels II-V ($P < 0.001$), with the exception of GMFCS level I ($P = 0.121$), where no significant difference was found. The prevalence of low LMI_{tot} (16.1%; 95% CI: 16.1, 20.1%) was significantly lower ($P < 0.001$) than the prevalence of LMI_{app} (42.2%; 95% CI: 36.9, 47.9%) in the study population. **CONCLUSIONS:** The prevalence of low skeletal muscle mass in children with CP might be underestimated by LMI_{tot}. LMI_{app} is more suitable for the evaluation of skeletal muscle mass in children with CP.

PMID: [31204786](#)

4. Dynamic stability during walking in children with and without cerebral palsy.

Tracy JB, Petersen DA, Pigman J, Conner BC, Wright HG, Modlesky CM, Miller F, Johnson CL, Crenshaw JR.

Gait Posture. 2019 Jun 11;72:182-187. doi: 10.1016/j.gaitpost.2019.06.008. [Epub ahead of print]

BACKGROUND: Cerebral palsy (CP) is associated with a high risk of falling during walking. Many gait abnormalities associated with CP likely alter foot placement and center of mass (CoM) movement in a way that affects anterior or lateral dynamic stability, in turn influencing fall risk. **RESEARCH QUESTION:** Do children with CP demonstrate altered anterior or lateral dynamic stability compared to typically-developing (TD) children? **METHODS:** In this case-control, observational study, we measured gait kinematics of two groups of children (15 CP, 11 GMFCS level I, 4 GMFCS level II; 14 TD; age 5-12) in walking conditions of a preferred speed, a fast speed, and a preferred speed while completing a cognitive task. For dominant and non-dominant limbs, the margin of stability (MoS), a spatial measure of dynamic stability, was calculated as the distance between the edge of the base of support and the CoM position after accounting for scaled velocity. Statistical comparisons of were made using mixed factorial ANOVAs. Post hoc comparisons were Sidak adjusted. **RESULTS:** The anterior MoS before foot strike and at mid-swing differed between each condition but not between groups. Based on the minimum lateral MoS, children with CP had more stability when bearing weight on their non-dominant limb compared to TD children. These differences were not apparent when on the dominant limb. **SIGNIFICANCE:** This high-functioning group of children with CP exhibited a more conservative lateral stability strategy during walking when bearing weight with the non-dominant limb. This strategy may be protective against lateral falls. We observed no between-group differences in anterior stability. Because CP has been previously associated with impaired anterior balance reactions, and there was no observed compensation in anterior gait stability, this lack of group differences could contribute to a higher risk of falling in that direction.

PMID: [31226600](#)

5. Intraoperative experiments combined with gait analyses indicate that active state rather than passive dominates the spastic gracilis muscle's joint movement limiting effect in cerebral palsy.

Kaya CS, Bilgili F, Akalan NE, Temelli Y, Ateş F, Yucesoy CA.

Clin Biomech (Bristol, Avon). 2019 Jun 7;68:151-157. doi: 10.1016/j.clinbiomech.2019.06.005. [Epub ahead of print]

BACKGROUND: In cerebral palsy, spastic muscle's passive forces are considered to be high but have not been assessed directly. Although activated spastic muscle's force-joint angle relations were studied, this was independent of gait relevant joint positions. The aim was to test the following hypotheses intraoperatively: (i) spastic gracilis passive forces are high even in flexed knee positions, (ii) its active state forces attain high amplitudes within the gait relevant knee angle range, and (iii) increase with added activations of other muscles.

METHODS: Isometric forces (seven children with cerebral palsy, gross motor function classification score = II) were measured during surgery from knee flexion to full extension, at hip angles of 45° and 20° and in four conditions: (I) passive state, after gracilis was stimulated (II) alone, (III) simultaneously with its synergists, and (IV) also with an antagonist. **FINDINGS:** Directly measured peak passive force of spastic gracilis was only a certain fraction of the peak active state forces (maximally 26%) measured in condition II. Conditions III and IV caused gracilis forces to increase (for hip angle = 45°, by 32.8% and 71.9%, and for hip angle = 20°, by 24.5% and 45.1%, respectively). Gait analyses indicated that intraoperative data for knee angles 61-17° and 33-0° (for hip angles 45° and 20°, respectively) are particularly relevant, where active state force approximates its peak values. **INTERPRETATION:** Active state muscular mechanics, rather than passive, of spastic gracilis present a capacity to limit joint movement. The findings can be highly relevant for diagnosis and orthopaedic surgery in individuals with cerebral palsy.

PMID: [31212210](#)

6. The Pediatric Temporal-spatial Deviation Index: quantifying gait impairment for children with cerebral palsy.

Zhou JY, Zhang K, Cahill-Rowley K, Lowe E, Rose J.

Dev Med Child Neurol. 2019 Jun 17. doi: 10.1111/dmcn.14271. [Epub ahead of print]

AIM: To develop an easily-administered metric to quantify gait impairment in children and to assess its use in children with cerebral palsy (CP). **METHOD:** The Pediatric Temporal-spatial Deviation Index (TDI) was developed from gait data collected from 75 typically developing children (37 males, 38 females; mean age 9y 4mo; interquartile range [IQR] 8-10y) and 17 children diagnosed with spastic CP (nine males, eight females; mean age 9y 9mo; IQR 9-11y), in Gross Motor Function Classification System (GMFCS) levels I to III, aged 7 to 11 years. Children walked on a pressure-sensitive mat. Children with CP also completed 3D gait analysis. The Kaiser-Meyer-Olkin test of sampling adequacy was used for temporal-spatial feature selection. Principal components obtained from temporal-spatial gait parameters quantified deviation from typically developing gait. Deviation was normalized to a Pediatric TDI score mean (standard deviation [SD]) of 100 (10). The Pediatric TDI for children with CP was compared to 3D motion capture-based Gait Deviation Index (GDI). **RESULTS:** The Pediatric TDI was significantly lower for children with CP compared to typically developing children ($p < 0.001$), correlated with average GDI ($r = 0.610$, $p = 0.009$), and demonstrated sensitivity (0.78) and specificity (0.88) to gait function, assessed with GDI. **INTERPRETATION:** The Pediatric TDI is an easily administered, revealing gait metric that can be used in children with CP in pediatric clinics and for research. Detection of gait abnormalities in the clinic can expedite diagnosis and treatment. What this paper adds The Pediatric Temporal-spatial Deviation Index (TDI) is a single-score index of gait deviation, based on nine parameters. The Pediatric TDI was more revealing than single temporal-spatial gait parameters. The Pediatric TDI is quick and simple to administer in the clinic.

PMID: [31206183](#)

7. Identification of gait events in children with spastic cerebral palsy: comparison between the force plate and algorithms.

Gonçalves RV, Fonseca ST, Araújo PA, Araújo VL, Barboza TM, Martins GA, Mancini MC.

Braz J Phys Ther. 2019 Jun 12. pii: S1413-3555(19)30076-0. doi: 10.1016/j.bjpt.2019.05.007. [Epub ahead of print]

OBJECTIVE: To compare the gait event identification of five algorithms recommended in the literature with those provided by force plate (gold standard) in children with unilateral or bilateral spastic cerebral palsy (SCP). **METHODS:** This was a cross-sectional study of the gait of three girls and four boys with a mean age of 8.6±4.7 years. Four children had unilateral SCP with an equinus gait pattern, and the remaining three children exhibited bilateral SCP with a slide/drag gait pattern. Kinematic and kinetic gait data were collected during barefoot walking at a comfortable speed. From a total of 202 steps, the detection of 202 foot-strike (FS) and 194 toe-off (TO) events by each algorithm was compared with the detection of these same events by the force plate. The error between the events detected by the algorithms and those detected by the force plate was determined in milliseconds. Repeated measures ANOVA was used to compare the errors among the algorithms. **RESULTS:** The algorithm reported by Ghousayni et al. showed the best performance in all situations, except for the identification of FS events on the unaffected side in children with unilateral SCP. For these events, the algorithms reported by Desailly et al. and Zeni et al. showed the best performance. **CONCLUSION:** Ghousayni et al.'s algorithm can be used to detect gait events in children with SCP when a force plate is not available.

PMID: [31208861](#)

8. The Effects of Functional Progressive Strength and Power Training in Children With Unilateral Cerebral Palsy.

Kaya Kara O, Livanelioglu A, Yardımcı BN, Soylu AR.

Pediatr Phys Ther. 2019 Jul;31(3):286-295. doi: 10.1097/PEP.0000000000000628.

PURPOSE: The purpose of this study was to investigate the effects of a novel functional strength and power-training program on gait and gross motor function in participants with unilateral cerebral palsy. **METHODS:** This 12-week trial of functional strength and power training included 30 participants with cerebral palsy, randomly assigned to the experimental or comparison group. The primary outcomes, 1-minute walk test, muscle power, and the Gross Motor Function Measure, were assessed at baseline and 12 weeks after the intervention. Secondary outcomes included dynamic balance as measured by Timed Up and Go, muscle strength, and 1-repetition maximum measures. **RESULTS:** Significantly greater improvements were seen in the experimental group for muscle power, Gross Motor Function Measure E score, and 1-minute walk test ($P < .05$), as well as for dynamic balance, 1-repetition maximum, and muscle strength. **CONCLUSION:** Functional strength training combined with plyometric exercises improved gait and gross motor function, dynamic balance, muscle strength, and power.

PMID: [31220015](#)

9. Effects of a training programme of functional electrical stimulation (FES) powered cycling, recreational cycling and goal-directed exercise training on children with cerebral palsy: a randomised controlled trial protocol.

Armstrong EL, Boyd RN, Kentish MJ, Carty CP, Horan SA.

BMJ Open. 2019 Jun 17;9(6):e024881. doi: 10.1136/bmjopen-2018-024881.

INTRODUCTION: Children with cerebral palsy (CP) experience declines in gross motor ability as they transition from childhood to adolescence, which can result in the loss of ability to perform sit-to-stand transfers, ambulate or participate in leisure activities such as cycling. Functional electrical stimulation (FES) cycling is a novel technology that may provide opportunities for children with CP to strengthen their lower limbs, improve functional independence and increase physical activity participation. The proposed randomised controlled trial will test the efficacy of a training package of FES cycling, adapted cycling and goal-directed functional training to usual care in children with CP who are susceptible to functional declines. **METHODS AND ANALYSIS:** Forty children with CP (20 per group), aged 6-8 years and classified as Gross Motor Function Classification System (GMFCS) levels II-IV will be recruited across South East Queensland. Participants will be randomised to either an immediate intervention group, who will undertake 8 weeks of training, or a waitlist control group. The training group will attend two 1 hour sessions per week with a physiotherapist, consisting of FES cycling and goal-directed, functional exercises and a 1 hour home exercise programme per week, consisting of recreational cycling. Primary outcomes will be the gross motor function measure and Canadian occupational performance measure, and secondary outcomes will include the five times sit-to-stand test, habitual physical activity (accelerometry), power output during cycling and Participation and Environment Measure-Children and Youth. Outcomes will be assessed at baseline, postintervention (8 weeks) and 8 weeks following the intervention (retention). **ETHICS AND DISSEMINATION:** Ethical approval has been obtained from Griffith University (2018/037) and the Children's Health Queensland Hospital and Health Service (CHQHHS) Human Research Ethics Committee (HREC/17/QRCH/88). Site-specific approval was obtained from CHQHHS research governance (SSA/17/QRCH/145). Results from this trial will be disseminated via publication in relevant peer-reviewed journals.

PMID: [31213443](#)

10. Stretching and Progressive Resistance Exercise in Children With Cerebral Palsy: A Randomized Controlled Trial.

Fosdahl MA, Jahnsen , Kvalheim , Holm I.

Pediatr Phys Ther. 2019 Jul;31(3):264-271. doi: 10.1097/PEP.0000000000000616.

PURPOSE: To evaluate the effect of stretching and progressive resistance exercise on range of motion and muscle strength in children with cerebral palsy. **METHODS:** Thirty-seven children with spastic bilateral cerebral palsy and Gross Motor Function Classification System levels I to III were randomized to an intervention and a comparison group. The intervention included stretching of hamstrings and progressive resistance exercise, targeting the lower extremities for 16 weeks, followed by a 16-week maintenance program. Passive and active popliteal angle and muscle strength were evaluated at 0, 16, and 32 weeks. **RESULTS:** After 16 weeks nonsignificant improvements were found in passive, active popliteal angle and quadriceps and hamstrings strength. **CONCLUSION:** A 16-week stretching and progressive resistance exercise program followed by a 16-week maintenance program showed nonsignificant improvements in passive, active popliteal angle and muscle strength for the intervention group.

PMID: [31220010](#)

11. Documenting Physical Therapy Dose for Individuals With Cerebral Palsy: A Quality Improvement Initiative.

Bailes AF, Strenk ML, Quatman-Yates C, Hobart J, Furnier A.

Pediatr Phys Ther. 2019 Jul;31(3):234-241. doi: 10.1097/PEP.0000000000000614.

PURPOSE: To describe the quality improvement (QI) activities used to improve treatment dose documentation for individuals with cerebral palsy (CP) and to discuss insights gained from this project.

METHODS: Global and smart aims were established and interventions were tested from January 2017 through February 2018 using Plan-Do-Study-Act cycles.

Performance was tracked overtime using run and control charts. **RESULTS:** The QI initiative resulted in a sustainable increase in percentage of dose elements present in the electronic medical record from 78% to 94%. Key drivers of improvement included (1) knowledge and awareness of dose, (2) clinician buy-in, (3) effective engagement of child and parent, (4) therapist knowledge of evidence-based treatments, (5) transparent and reliable documentation system, and (6) audit and clinician feedback. **CONCLUSIONS:** QI methods provided the tools to improve workflow and increase dose documentation for individuals with CP.

PMID: [31206504](#)

12. Visual Function Classification System for children with cerebral palsy: development of a new tool.

Rosenbaum P.

Dev Med Child Neurol. 2019 Jun 17. doi: 10.1111/dmcn.14279. [Epub ahead of print]

PMID: [31206620](#)

13. Fatigue in children with perinatal stroke: clinical and neurophysiological associations.

Wrightson JG, Zewdie E, Kuo HC, Millet GY, Kirton A.

Dev Med Child Neurol. 2019 Jun 20. doi: 10.1111/dmcn.14273. [Epub ahead of print]

AIM: To characterize fatigue in children with hemiparesis with perinatal stroke and explore associations with measures of motor performance and corticospinal excitability. **METHOD:** Forty-five children (16 females, 29 males), aged 6 to 18 years (mean [SD] 12y [4]), with magnetic resonance imaging-confirmed perinatal stroke participated. Associations between fatigue (Pediatric Quality of Life Inventory Version 3.0 cerebral palsy module fatigue subscale), motor performance (Assisting Hand Assessment [AHA], Box and Blocks Test, grip strength), and excitability of corticospinal projections to both hands were examined using ranked tests of correlation, robust regression, and the Mann-Whitney U test. **RESULTS:** Nearly half of the participants (n=21) reported experiencing fatigue in the previous month. Function in the less affected hand (Box and Blocks Test, grip strength) was correlated with fatigue scores. Participants with preserved ipsilateral projections to the more affected hand had less fatigue, and scores correlated with the excitability of these projections. Fatigue scores were not associated with age, sex, or AHA score. **INTERPRETATION:** Fatigue is common in children with hemiparesis with perinatal stroke and is associated with motor performance and the presence and excitability of ipsilateral corticospinal projections from the contralesional hemisphere to the more affected hand. **WHAT THIS PAPER ADDS:** Fatigue is common in children with hemiparesis with perinatal stroke. Fatigue was associated with motor performance and strength in the less affected, but not the more affected, hand. Fatigue was associated with the presence and excitability of ipsilateral corticospinal projections from the contralesional hemisphere.

PMID: [31222717](#)

14. Back pain is more frequent in girls and in children with scoliosis in the context of cerebral palsy.

Hägglund G, Czuba T, Alriksson-Schmidt AI.

Acta Paediatr. 2019 Jun 19. doi: 10.1111/apa.14909. [Epub ahead of print]

AIM: To investigate the prevalence of general and back pain in children with cerebral palsy and the relationships between scoliosis and back pain. **METHODS:** Cross-sectional register study based on data from the Swedish Cerebral Palsy Follow-Up Programme. Descriptive analyses and logistic regression to regress age, sex, gross motor function, windswept, hip extension and source of report on the presence of pain. **RESULTS:** The study included 3783 children (58% boys) 1-18 (mean 10.0) years of age. General pain was reported in 1538 (44% girls, 38% boys) and back pain in 226 (7% girls, 5% boys) children. The proportion of back pain increased from <4% prior to age 12 years to >12% from 16 years of age. Back pain increased from 4% in children without scoliosis to 16% in children with severe scoliosis. Moderate/severe back pain increased from 2% in children without scoliosis to 10% in children with severe scoliosis. Increased odds of reporting back pain were found for age, girls, low gross motor function and children with scoliosis. **CONCLUSION:** The proportion of children with general pain increased with age and was more frequent in girls. Age, female sex, low gross motor function and scoliosis were significant predictors of back pain. This article is protected by copyright. All rights reserved.

PMID: [31218743](#)

15. Validation of the Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD) in a sample of Turkish non-ambulatory children with cerebral palsy.

Şimşek TT, Sertel M, Yümin ET, Aras B, Narayanan UG.

Turk Pediatri Ars. 2019 Mar 1;54(1):13-27. doi: 10.14744/TurkPediatriArs.2019.57778. eCollection 2019.

Aim: The aim of this study was to translate and transculturally adapt the Caregiver Priorities and Child Health Index of Life with Disabilities questionnaire into the Turkish language and test the reliability and validity. **Material and Methods:** Eighty-two children with cerebral palsy and their parents were included in the study. The majority of children had spastic cerebral palsy. According to the Gross Motor Function Classification System, 26 children were level III, 30 children were level IV, and 26 children were level V. International accepted guidelines were used in the transcultural adaptation and validation process. Reliability was assessed through statistical analysis of the test results for test-retest and internal consistency. To assess construct validity, Caregiver Priorities and Child Health Index of Life with Disabilities was compared with the Child Health Questionnaire Parent Form. Concurrent validity was assessed by examining how Caregiver Priorities and Child Health Index of Life with Disabilities scores changed according to Gross Motor Function Classification System levels. **Results:** The mean total score of Caregiver Priorities and Child Health Index of Life with Disabilities was 58.34 ± 26.39 . The intraclass correlation coefficient for the total questionnaire score was 0.75, ranging from 0.43 to 0.89 for six domains. Cronbach's alpha was above 0.80 in all domains of Caregiver Priorities and Child Health Index of Life with Disabilities, except the health domain. The construct validity was good because there was a positive correlation between total Child Health Questionnaire Parent Form and Caregiver Priorities and Child Health Index of Life with Disabilities scores ($r=0.58$, $p<0.01$) according to the Pearson correlation analysis. Caregiver Priorities and Child Health Index of Life with Disabilities scores were found to be different between Gross Motor Function Classification System levels ($p<0.05$). **Conclusion:** This study showed that the Caregiver Priorities and Child Health Index of Life with Disabilities appears to be easy to administer, seems to have significant validity and reliability, and may be useful in the evaluation of health-related quality of life of children with cerebral palsy.

PMID: [31217705](#)

16. Cross-cultural adaptation and validation of the Ukrainian version of the ABILHAND-Kids questionnaire.

Hasiuk MB, Arnould C, Kushnir AD, Matiushenko OA, Kachmar OO.

Disabil Rehabil. 2019 Jun 19:1-10. doi: 10.1080/09638288.2019.1630677. [Epub ahead of print]

Purpose: To develop and cross-culturally validate the Ukrainian version of the ABILHAND-Kids questionnaire by testing its psychometric properties in a sample of Ukrainian children with cerebral palsy. **Methods:** The ABILHAND-Kids questionnaire was translated into Ukrainian, cross-culturally adapted, and administered to 113 parents of children with cerebral palsy. The psychometric properties of the Ukrainian version and its cross-cultural validation were investigated through the Rasch rating scale model. **Results:** One major misfit has been found for the item "Rolling up a sleeve of a sweater" that further was removed. The item "Putting on a backpack/schoolbag" was split into gender-specific items, separately for girls and for boys, as it was systematically easier for Ukrainian girls. All remaining items contributed to the definition of a unidimensional measure of manual ability. The internal consistency reliability of the scale was high ($R = 0.95$). No significant floor (4%) and ceiling effects (5%) were observed. Three major differential item functioning items were found across Belgium and Ukraine, highlighting the need to use the Ukrainian calibration of ABILHAND-Kids in Ukraine. **Conclusion:** The Ukrainian ABILHAND-Kids questionnaire has good psychometric properties for assessing manual ability in Ukrainian children with cerebral palsy, holding potential to be implemented in clinical practice nationwide. Implications for rehabilitation Cerebral palsy impairs manual ability leading to decreased quality of life and participation. Professionals need valid and reliable tools to detect small changes of manual ability during rehabilitation. Metric properties and availability of the Ukrainian version of the ABILHAND-Kids questionnaire make it a useful tool in the assessment of children with cerebral palsy.

PMID: [31213105](#)

17. The effects of robotic gait neurorehabilitation and focal vibration combined treatment in adult cerebral palsy.

Rutović S, Glavić J, Cvitanović NK.

Neurol Sci. 2019 Jun 16. doi: 10.1007/s10072-019-03965-6. [Epub ahead of print]

PMID: [31203480](#)

18. Deep brain stimulation for cerebral palsy: where are we now?

Sanger TD.

Dev Med Child Neurol. 2019 Jun 18. doi: 10.1111/dmcn.14295. [Epub ahead of print]

Cerebral palsy (CP) is a complex disorder and children frequently have multiple impairments. Dystonia is a particularly frustrating impairment that interferes with rehabilitation and function and is difficult to treat. Of the available treatments, deep brain stimulation (DBS) has emerged as an option with the potential for large effect size in a subgroup of children. While brain stimulation has been used in CP for more than 40 years, modern devices and targeting methods are improving both the safety and efficacy of the procedure. Successful use of DBS depends on appropriate selection of patients, identification of effective neuroanatomical targets in each patient, careful neurosurgical procedure, and detailed follow-up evaluation and programming. The use of functional neurosurgery for neuromodulation in CP remains a technology in its infancy, but improving experience and knowledge are likely to make this one of the safest and most effective interventions for children with moderate-to-severe motor disorders. This review summarizes the current procedures for patient and target selection, and surgical implantation of DBS electrodes for CP. The history of DBS and future directions when used in secondary dystonia are also examined. WHAT THIS PAPER ADDS: Selection of candidates for deep brain stimulation (DBS) requires understanding of dystonia in cerebral palsy. DBS could become a first-line treatment option in some children.

PMID: [31211420](#)

19. Positive and negative conditioning in the neonatal brain.

Vexler ZS, Mallard C, Hagberg H.

Cond Med. 2018 Oct;1(6):279-293.

Brain injury in the perinatal period occurs in many clinical settings, e.g. hypoxic-ischemic encephalopathy (HIE) in term infants, neonatal stroke, encephalopathy of prematurity, and infections. These insults often result in life-long disabilities including cerebral palsy, cognitive deficits, visual dysfunction, hearing impairments, and epilepsy. However, the success of clinical implementation of a broad array of potential neuroprotective strategies tested experimentally has been limited with the exception of therapeutic hypothermia (TH) used within hours of birth in term human babies with mild to moderate HIE. There is an extensive search for adjuvant therapeutic approaches to enhance the outcomes. One strategy is to modify susceptibility in the developing CNS by means of preconditioning or postconditioning using sublethal stress. The pre-clinical and clinical literature has shown that CNS immaturity at the time of ischemic insult plays a central role in the response to injury. Thus, better understanding of the molecular regulation of the endogenous vulnerability of the immature brain is needed. Further, the use of sublethal stressors of different origin may help shed light on mechanistic similarities and distinctions between conditioning strategies. In this review we discuss the mechanisms of protection that are achieved by an interplay of changes on the systemic level and brain level, and via changes of intracellular and mitochondrial signaling. We also discuss the barriers to improving our understanding of how brain immaturity and the type of insult-hypoxic, ischemic or inflammatory-affect the efficacy of conditioning efforts in the immature brain.

PMID: [31214666](#)

20. Congenital Anomalies in Children With Cerebral Palsy: A Systematic Review.

Goldsmith S, McIntyre S, Hansen M, Badawi N.

J Child Neurol. 2019 Jun 17;883073819854595. doi: 10.1177/0883073819854595. [Epub ahead of print]

Congenital anomalies are a strong risk factor for cerebral palsy, particularly for children born at term. This systematic review aimed to address gaps in our understanding of the association between congenital anomalies and cerebral palsy. Eight population-based studies (n = 10 081) were identified. Congenital anomalies were reported in 12% to 32% of children with pre/perinatal brain injury and 20% of children with postneonatal brain injury. Variation between studies included study cohort inclusion criteria and the definitions and classification of included anomalies. The most common cerebral anomalies were microcephaly and hydrocephaly, whereas circulatory system anomalies were the most common noncerebral anomalies. The proportion of congenital anomalies was higher in children born at term than preterm. Synthesizing the highest quality data published, this review identified that congenital anomalies are common in cerebral palsy. New collaborative research, addressing sources of variation, is vital to identify pathways to cerebral palsy that include specific congenital anomalies, and explore opportunities for prevention.

PMID: [31208251](#)

21. Long-term effects of repeated botulinum neurotoxin A, bimanual training, and splinting in young children with cerebral palsy.

Lidman GRM, Nachemson AK, Peny-Dahlstrand MB, Himmelmann KME.

Dev Med Child Neurol. 2019 Jun 21. doi: 10.1111/dmcn.14298. [Epub ahead of print]

AIM: To investigate long-term development of hand function after repeated botulinum neurotoxin A (BoNT-A) and occupational therapy at a young age.

METHOD: Twenty children with unilateral spastic cerebral palsy (CP) (14 males, six females; median inclusion age 3y 1mo, range 1y 11mo-4y 3mo) participated in this longitudinal study. Ten children received occupational therapy after a randomized controlled trial and 10 repeated BoNT-A plus occupational therapy during 1-year. The Assisting Hand Assessment (AHA) and active supination, assessed the following 3 years. The assessments were compared with data from a reference group to investigate development over time. **RESULTS:** The improvement in AHA (7.5 AHA units) after BoNT-A plus occupational therapy was maintained at final follow-up. The occupational therapy group, unchanged after 1-year, improved by 5 AHA units (96% confidence interval [CI] 2-10), thus there was no difference between the groups. Median active supination increased in comparison with the reference group. In the BoNT-A/occupational therapy group, 9 out of 10 (97.85% CI 45 115) children improved in active supination. In the occupational therapy group, 7 out of 10 (97.85% CI -2 to 68) children improved in active supination. No correlation between active supination and AHA was found. **INTERPRETATION:** Bimanual performance achieved after BoNT-A plus occupational therapy was maintained, while it increased by follow-up in the occupational therapy group, suggesting that combined intervention gave earlier access to bimanual skills. Active supination was unrelated to AHA.

PMID: [31225647](#)

22. Intrathecal baclofen as a treatment for spasticity: Review of the cases treated in our hospital.

Santin-Amo JM, Flores-Justa A, Román-Pena P, Raposo-Furelos M, Frieiro-Dantas C, Serramito García R, Villa JM, Gelabert-González M.

Neurocirugia (Astur). 2019 Jun 14. pii: S1130-1473(19)30046-6. doi: 10.1016/j.neucir.2019.05.001. [Epub ahead of print]

INTRODUCTION: Spasticity represents a medical problem whose incidence is increasing during the last years due to pathologies such as cerebral palsy, stroke, multiple sclerosis, trauma or encephalopathy, affecting both adults and children. The treatments include rehabilitation, pharmacotherapy and surgery, among which we highlight intrathecal baclofen infusion devices. **MATERIAL AND METHODS:** Intrathecal baclofen devices implanted patients in Clinical Hospital of Santiago de Compostela from 2005 to 2018 were selected for retrospective analysis using assessment of spasticity scales, such as Ashworth scale. Complications are described. **RESULTS:** Surgery was performed in 17 patients for baclofen pump implant, achieving an improvement of 2 points on the Ashworth Scale in 88,2% of the patients and of 1 point on the Penn Scale in 94%. Complications were seen in 3 patients. **CONCLUSIONS:** Intrathecal baclofen is a simple technique with good results for improving the quality of life of patients with spasticity.

PMID: [31208871](#)

23. More than an X-ray: Experiences and perspectives of parents of children with cerebral palsy when engaging in hip surveillance.

Toovey R, Willoughby KL, Hodgson JM, Graham HK, Reddihough DS.

J Paediatr Child Health. 2019 Jun 17. doi: 10.1111/jpc.14537. [Epub ahead of print]

AIM: We explored the experiences of parents of children with cerebral palsy (CP) when engaging in hip surveillance for their child and aimed to identify the barriers and facilitators they encounter. **METHODS:** We conducted a pragmatic qualitative study through five focus groups conducted with 23 parents and primary care givers of young people with cerebral palsy. A semi-structured topic guide was used to facilitate discussion. Recordings were transcribed verbatim and transcripts analysed using content analysis. **RESULTS:** Six major categories emerged: (i) hip surveillance is a shared responsibility; (ii) knowledge is empowering; (iii) hip surveillance should be proactive rather than reactive; (iv) consistency and support from health professionals is valuable; (v) good communication is crucial; and (vi) challenges associated with having an X-ray may not be appreciated. Participants made recommendations related to: service model enhancements, information provision and improving both communication and the experience of having an X-ray. **CONCLUSION:** Despite having a good understanding of the need and importance of hip surveillance for their child, several barriers to parent engagement exist. Findings will inform the implementation of a family-centred model for hip surveillance and may be relevant to those undertaking or planning the implementation of hip surveillance in other areas.

PMID: [31206912](#)

24. Early Intervention Therapy Services for Infants With or at Risk for Cerebral Palsy.

Gmmash AS, Effgen SK.

Pediatr Phys Ther. 2019 Jul;31(3):242-249. doi: 10.1097/PEP.0000000000000619.

OBJECTIVE: The purpose of this study was to explore the practices physical therapists and occupational therapists use in early intervention (EI) for infants with or at risk for cerebral palsy (CP). **METHODS:** A survey was disseminated nationally to EI providers using an online anonymous link. **RESULTS:** Two hundred sixty-nine therapists completed at least 50% of the survey. Four percent of therapists use the General Movement Assessment to predict CP, 57% reported infants at risk for CP receive

therapy once a week, 89% identified parents' goals as the most important factor in customizing the EI program, and 75% provide parents with home programs. However, 73% never or rarely use outcome measures to prioritize parents' goals; 31% provide parents with individualized home program and more than 60% never assess environmental enrichment. CONCLUSION: Therapists do not incorporate sufficient strategies for goal-oriented interventions, comprehensive parent education, and optimum environmental enrichment.

PMID: [31225829](#)

25. Claims about medical malpractices resulting in neonatal and maternal impairment in Iran.

Taghizadeh Z, Pourbakhthiar M, Azimi K, Ghadipasha M, Soltani K.

J Forensic Leg Med. 2019 Jun 15;66:44-49. doi: 10.1016/j.jflm.2019.06.008. [Epub ahead of print]

BACKGROUND: Today even low incidence of complications for mothers or neonates during pregnancy, delivery or postpartum is unacceptable to the public and can result in claims because of greater expectation from patients and an increase in media coverage. The present study was conducted to investigate the reasons for medical malpractice claims on maternal and neonatal impairment, which are achieved in Iranian Legal Medicine Organization councils. MATERIALS AND METHODS: The present cross-sectional and retrospective study used convenience sampling to collect data of total claims from 31 provinces archived in the supreme council of the ILMO in 2 years. In this article, the medical malpractice claims on maternal and neonatal impairment during pregnancy, labour, delivery and early postpartum were reported. The data were collected through a validated researcher-made checklist and were analyzed in SPSS 16. RESULTS: Among total of 299 cases of impairment, cerebral palsy (33.34%), Erb's palsy due to shoulder dystocia (24.24%) and Down Syndrome (24.24%) were the main confirmed causes of malpractice for neonatal impairment and Retained Surgical Mass (20.5%), Salpingectomy and/or Oophorectomy Related to EP (17.2%), Hysterectomy (17.2%) and Episiotomy Related complication (17.2%) were the main confirmed causes of malpractice for maternal impairment. CONCLUSION: Considering this fact that medical malpractice was confirmed in a large proportion of some preventable and important complications, therefore, results of this study can be used for developing educational programs for related healthcare providers to prevent those complications.

PMID: [31220788](#)

26. Development and Validation of Equations to Link Pediatric Evaluation of Disability Inventory (PEDI) Functional Skills Scores to PEDI-Computer Adaptive Test Scores for Youth with Cerebral Palsy.

Fragala-Pinkham MA, Miller PE, M Dumas H, Shore BJ.

Phys Occup Ther Pediatr. 2019 Jun 17:1-15. doi: 10.1080/01942638.2019.1628160. [Epub ahead of print]

Aim: The Pediatric Evaluation of Disability Inventory (PEDI) was revised to the PEDI-Computer Adaptive Test (PEDI-CAT). The PEDI has been used for over two decades to track function in youth, so it is important that follow-up data are not lost with this transition. The purpose of this study was to develop and validate equations for linking PEDI scores to PEDI-CAT scores. Methods: Caregivers of 101 youth 6.1 to 19.8 years of age with cerebral palsy (CP) and classified at Gross Motor Classification System (GMFCS) Levels I-V completed the PEDI and PEDI-CAT. Scaled score data from this sample were used to develop and validate linking equations using least squares regression and bootstrap cross-validation techniques. Next, equations were tested in an independent sample of 35 children with developmental disabilities. Results: The equations to predict PEDI-CAT scores exhibited excellent model fit. PEDI Self-care, Mobility, and Social Function explained 92%, 84%, and 85% of the variation in PEDI-CAT Daily Activities, Mobility, and Social/Cognitive domains, respectively. No differences were detected between actual and predicted PEDI-CAT scores across all domains and by GMFCS level for the equation development sample and for an equation validation independent sample. Conclusions: The model fit was excellent; however, equations should be used cautiously when evaluating changes in function for individual children with ceiling level PEDI scores. Valid score prediction equations for youth with CP will assist with transitioning from the PEDI to the PEDI-CAT.

PMID: [31203687](#)