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Interventions and Management

1. Res Dev Disabil. 2015 Jul 9;43-44:97-105. doi: 10.1016/j.ridd.2015.06.013. [Epub ahead of print]

Intensive upper limb intervention with self-management training is feasible and promising for older children and adolescents with unilateral cerebral palsy.

Geerdink Y, Aarts P, van der Burg J, Steenbergen B, Geurts A.

This study explored the feasibility and preliminary effectiveness of a short (one week) intensive intervention combining Constraint Induced Movement Therapy (CIMT) and bimanual training (BiT) to improve upper limb capacity and bimanual performance guided by individual goal setting in children and adolescents with unilateral cerebral palsy aged 8-18 years. Self-management training was added to the intervention to maximize the effect of training and to empower the participants in self-monitoring the effective use of their affected hand. Functional goals (Canadian Occupational Performance Measure), unimanual capacity (Box and Block Test), bimanual performance (ABILHAND-Kids, Children's Hand-use Experience Questionnaire (CHEQ)) and amount of use (Video Observation Aarts and Aarts - determine developmental disregard (VOAA-DDD-R)) were measured at baseline, one week and four months post intervention. Twenty children (mean age 9.5 years) participated. Repeated measures ANOVA was used to measure effects over time. Compared to baseline, there were significant improvements on all outcome measures. The largest effect sizes were found for the COPM-performance and COPM-satisfaction (Cohen's $d=2.09$ and $d=2.42$, respectively). The effect size was large for the ABILHAND-Kids ($d=0.86$), moderate for the CHEQ ($d=0.70$) and Box and Block Test ($d=0.56$), and small for the VOAA-DDD-R ($d=0.33$). All effects were retained at the four months post intervention assessment. The results of this study indicate that one-week (36h) intensive CIMT-BiT combined with self-management training is a feasible and promising intervention for improving the capacity of the upper limb and its use in bimanual activities in older children and adolescents with unilateral CP.

[PMID: 26164301](#)

2. Res Dev Disabil. 2015 Jul 13;43-44:136-149. doi: 10.1016/j.ridd.2015.06.014. [Epub ahead of print]

Capturing neuroplastic changes after bimanual intensive rehabilitation in children with unilateral spastic cerebral palsy: A combined DTI, TMS and fMRI pilot study.

Bleyenheuft Y, Dricot L, Gilis N, Kuo HC, Grandin C, Bleyenheuft C, Gordon AM, Friel KM.

Intensive rehabilitation interventions have been shown to be efficacious in improving upper extremity function in

children with unilateral spastic cerebral palsy (USCP). These interventions are based on motor learning principles and engage children in skillful movements. Improvements in upper extremity function are believed to be associated with neuroplastic changes. However, these neuroplastic changes have not been well-described in children with cerebral palsy, likely due to challenges in defining and implementing the optimal tools and tests in children. Here we documented the implementation of three different neurological assessments (diffusion tensor imaging-DTI, transcranial magnetic stimulation-TMS and functional magnetic resonance imaging-fMRI) before and after a bimanual intensive treatment (HABIT-ILE) in two children with USCP presenting differential corticospinal developmental reorganization (ipsilateral and contralateral). The aim of the study was to capture neurophysiological changes and to document the complementary relationship between these measures, the potential measurable changes and the feasibility of applying these techniques in children with USCP. Independent of cortical reorganization, both children showed increases in activation and size of the motor areas controlling the affected hand, quantified with different techniques. In addition, fMRI provided additional unexpected changes in the reward circuit while using the affected hand.

[PMID: 26183338](#)

3. J Pediatr Orthop. 2015 Jul 14. [Epub ahead of print]

Correlation Between Standard Upper Extremity Impairment Measures and Activity-based Function Testing in Upper Extremity Cerebral Palsy.

James MA, Bagley A, Vogler JB 4th, Davids JR, Van Heest AE.

BACKGROUND: Although the treatment of cerebral palsy should be based on improving function as assessed by measures of impairment, activity, and participation, the standard indications for surgical treatment of upper extremity cerebral palsy (UECP) are impairment measures, primarily active and passive range of motion (ROM). Recently, validated activity measures have been developed for children with UECP. The purposes of this study were to determine the relationship between impairment and activity measures in this population, and whether measures of activity correlate with each other. **METHODS:** A total of 37 children, ages 5 to 16 years, who met standard ROM surgical indications for UECP were evaluated with the impairment measures of active and passive ROM and stereognosis, as well as 3 activity measures [Assisting Hand Assessment (AHA), Box and Blocks test, and the Shriners Hospitals Upper Extremity Evaluation Dynamic Positional Analyses (SHUEE DPA)]. Impairment measures were correlated with activity measures using Spearman rank correlation coefficients. **RESULTS:** Impairment measures showed inconsistent correlation with activity measures. Of the 12 comparisons, only 4 correlated: active forearm supination ($\rho=0.47$, $P=0.003$), wrist extension ($\rho=0.55$, $P=0.001$), and stereognosis scores ($\rho=0.54$, $P=0.001$) were correlated with AHA; and wrist extension was correlated with the SHUEE DPA ($\rho=0.41$, $P=0.01$). When the results of activity tests were compared, the AHA was correlated with the Box and Blocks tests ($\rho=0.63$, $P<0.001$), and the SHUEE DPA and Box and Blocks tests were correlated with each other ($\rho=0.35$, $P=0.04$). **CONCLUSIONS:** The goal of surgery in UECP is to improve the child's ability to perform activities, and ultimately to participate in life situations. Impairment measures, such as ROM, were inconsistently correlated with validated measures of activity. Some activity measures correlated with each other, although they did not correlate with the same impairment measures. We conclude that impairment measures, including ROM, do not consistently predict functional dynamic ROM used to perform activities for children with UECP. Activity limitation measures may provide more appropriate indicators than impairment measures for upper extremity surgery for this population. **LEVEL OF EVIDENCE:** Level II-diagnostic.

[PMID: 26177058](#)

4. Neural Regen Res. 2015 Apr;10(4):624-30. doi: 10.4103/1673-5374.155438.

Motor function outcomes of pediatric patients with hemiplegic cerebral palsy after rehabilitation treatment: a diffusion tensor imaging study.

Kim JH, Kwon YM, Son SM.

Previous diffusion tensor imaging (DTI) studies regarding pediatric patients with motor dysfunction have confirmed

the correlation between DTI parameters of the injured corticospinal tract and the severity of motor dysfunction. There is also evidence that DTI parameters can help predict the prognosis of motor function of patients with cerebral palsy. But few studies are reported on the DTI parameters that can reflect the motor function outcomes of pediatric patients with hemiplegic cerebral palsy after rehabilitation treatment. In the present study, 36 pediatric patients with hemiplegic cerebral palsy were included. Before and after rehabilitation treatment, DTI was used to measure the fiber number (FN), fractional anisotropy (FA) and apparent diffusion coefficient (ADC) of bilateral corticospinal tracts. Functional Level of Hemiplegia scale (FxL) was used to assess the therapeutic effect of rehabilitative therapy on clinical hemiplegia. Correlation analysis was performed to assess the statistical interrelationship between the change amount of DTI parameters and FxL. DTI findings obtained at the initial and follow-up evaluations demonstrated that more affected corticospinal tract yielded significantly decreased FN and FA values and significantly increased ADC value compared to the less affected corticospinal tract. Correlation analysis results showed that the change amount of FxL was positively correlated to FN and FA values, and the correlation to FN was stronger than the correlation to FA. The results suggest that FN and FA values can be used to evaluate the motor function outcomes of pediatric patients with hemiplegic cerebral palsy after rehabilitation treatment and FN is of more significance for evaluation.

[PMID: 26170825](#)

5. Spine (Phila Pa 1976). 2015 Jul 10. [Epub ahead of print]

The effect of botulinum toxin A injections in the spine muscles for cerebral palsy scoliosis, examined in a prospective, randomized triple-blinded study.

Wong C, Pedersen S, Kristensen BB, Gosvig K, Sonne-Holm S.

STUDY DESIGN: A prospective, randomized triple-blinded cross-over design treating with either botulinum toxin A (BXT) or Saline (NaCl). **OBJECTIVE:** To examine the efficacy of BTX treatment in cerebral palsy scoliosis (CPS). **SUMMARY OF BACKGROUND DATA:** Intramuscular injections with BTX have been used off label in treating CPS. One prospective study has been conducted, demonstrating in both radiological and clinical improvement, whilst showing no side effects or complications. **METHODS:** Subjects (brace treated CPS between 2 and 18 years) were injected using ultrasonic-guidance with either Saline or BTX in selected spine muscles with 6 months intervals (block randomization, sealed envelope). X-rays of the spine and clinical follow-up were captured before and 6 weeks after each injection. Primary outcome parameter was radiological change in Cobb's angle, where a seven degree change was regarded as an effect (1 SD). Radiological parameters were measured before and 6 weeks after treatment by 3 experienced doctors separately. Moreover, clinical results were evaluated by the pediatric quality of life (PQL) score and systematic open questioning of the parents about the child's wellbeing. Subjects, researchers and monitors were blinded during the trial. Appropriate permissions (2008-004584-19) and no funding were obtained. **RESULTS:** Sixteen cerebral palsy patients (GMFCS III-V) with CPS were consecutively included, whereas 6 patients were excluded. There were no drop-outs to follow-up, but one possible serious adverse event of pneumonia resulting in death was recorded and the study was terminated. No significant radiological or clinical changes were detected when compared to NaCl injections using Wilcoxon matched pair signed-rank test. **CONCLUSION:** No positive radiological or clinical effects were demonstrated by this treatment, except for the parent's initial subjective but positive appraisal of the effect. However, the study was terminated due to one possible severe adverse event and scheduled numbers needed to treat (hence power) were not reached.

[PMID: 26165216](#)

6. Surg Neurol Int. 2015 Jun 25;6:111. doi: 10.4103/2152-7806.159382. eCollection 2015.

Selective dorsal rhizotomy for spastic diplegia secondary to stroke in an adult patient.

Eppinger MA, Berman CM, Mazzola CA.

BACKGROUND: Selective dorsal rhizotomy (SDR) is often recommended for children with spastic paraparesis and cerebral palsy. SDR reduces spasticity in the lower extremities for these children with spastic paraplegia. However, SDR is infrequently recommended for adults with spasticity. Spastic diplegia in adult patients can be due to stroke,

brain or spinal cord injury from trauma, infection, toxic-metabolic disorders, and other causes. Although rarely considered, SDR is an option for adult patients with spastic diplegia as well. **CASE DESCRIPTION:** The authors describe a patient who underwent a SDR with a successful postoperative outcome. This man suffered a hypertensive and hemorrhagic stroke secondary to intravenous drug abuse at age 46. A SDR was performed after two failed intrathecal baclofen pump placements due to recurrent infections, likely resulting from his immunocompromised status. The patient underwent lumbar laminectomies and dorsal rhizotomies at levels L1-S1 bilaterally. Postoperatively, the patient's spasticity was significantly reduced. His Ashworth spasticity score decreased from 4/5 to 1/5, and the reduction in tone has been durable over 3 years. **CONCLUSION:** SDR in older patients with spastic paraparesis may be considered as a treatment option.

[PMID: 26167363](#)

7. Gait Posture. 2015 Jun 30. pii: S0966-6362(15)00691-8. doi: 10.1016/j.gaitpost.2015.06.189. [Epub ahead of print]

Sensitivity of the Oxford Foot Model to marker misplacement: A systematic single-case investigation.

Carty CP, Walsh HP, Gillett JG.

The purpose of this paper was to systematically assess the effect of Oxford Foot Model (OFM) marker misplacement on hindfoot relative to tibia, and forefoot relative to hindfoot kinematic calculations during the stance phase of gait. Marker trajectories were recorded with an 8-camera motion analysis system (Vicon Motion Systems Ltd., UK) and ground reaction forces were recorded from three force platforms (AMTI, USA). A custom built marker cluster consisting of 4 markers in a square arrangement (diagonal distance 2cm) was used to assess the effect of marker misplacement in the superior, inferior, anterior and posterior direction for the sustentaculum tali (STL), the proximal 1st metatarsal (P1M), distal 5th metatarsal (D5M), proximal 5th metatarsal (P5M) and lateral calcaneus (LCA) markers. In addition manual movement of the heel complex 1cm superiorly, inferiorly, medially and laterally, and also an alignment error of 10° inversion and 10° eversion was assessed. Clinically meaningful effects of marker misplacement were determined using a threshold indicating the minimal clinically important difference. Misplacement of the heel-wand complex had the most pronounced effect on mean kinematic profiles during the stance phase across all degrees-of-freedom with respect to hindfoot-tibia and forefoot-hindfoot angles. Vertical marker misplacement of the D5M and P5M markers affected the sagittal plane, and to a lesser extent frontal plane, forefoot-hindfoot kinematics. In conclusion, the OFM is highly sensitive to misplacement of the heel-wand complex in all directions and the P5M marker in the vertical direction.

[PMID: 26163347](#)

8. Gait Posture. 2015 Jun 29. pii: S0966-6362(15)00689-X. doi: 10.1016/j.gaitpost.2015.06.187. [Epub ahead of print]

Changes in gait which occur before and during the adolescent growth spurt in children treated by selective dorsal rhizotomy.

McFall J, Stewart C, Kidgell V, Postans N, Jarvis S, Freeman R, Roberts A.

This paper presents long term follow up results from 17 children (6 girls, 11 boys, GMFCS levels II-IV), treated by means of selective dorsal rhizotomy (SDR). The particular focus is on the effect of the adolescent growth spurt on patients who had previously undergone SDR. The children were all assessed using 3D gait analysis, in combination with clinical examination at three time points-before SDR surgery (PRE), after SDR surgery when pre-adolescent (POST1) and post-adolescence (POST2). The total follow up period to POST2 was 8 years 6 months for girls and 9 years 5 months for boys. All children maintained or improved their GMFCS level. Positive changes in ranges of motion and gait were observed at POST1 and these were generally maintained over adolescence to POST2. The mean Gait Profile Score (GPS) had improved by 3.2 points (14.7-11.5) at POST1, with a non-significant deterioration of 0.3 over the adolescent growth spurt. These positive results reflect the total package of care for the children, involving careful pre-operative selection by a multidisciplinary team and post-operative management including intensive physiotherapy and maintenance in tuned ankle foot orthoses. Fifty-nine per cent of children had

some additional orthopaedic surgery, mostly bony procedures. The overall benefits arising from their management need to be considered in the light of the likely deterioration experienced by this patient group. The results of this study support the use of SDR as part of a management strategy for carefully selected children with cerebral palsy with the aim of optimizing gait at skeletal maturity.

[PMID: 26164354](#)

9. J Pediatr Orthop. 2015 Jul 9. [Epub ahead of print]

Guided Growth of the Proximal Femur for Hip Displacement in Children with Cerebral Palsy: Response to the Readers' Comments.

Chang CH1.

[PMID: 26165553](#)

10. Dev Med Child Neurol. 2015 Jul 15. doi: 10.1111/dmcn.12846. [Epub ahead of print]

Clinical patterns of dystonia and choreoathetosis in participants with dyskinetic cerebral palsy.

Monbaliu E, de Cock P, Ortibus E, Heyrman L, Klingels K, Feys H.

AIM: The aim of the study was to map clinical patterns of dystonia and choreoathetosis and to assess the relation between functional classifications and basal ganglia and thalamus lesions in participants with dyskinetic cerebral palsy (CP). **METHODS:** In this cross-sectional study, 55 participants with dyskinetic CP (mean age 14y 6mo, SD 4y 1mo; range 6-22y) were assessed with the Dyskinesia Impairment Scale and classified with the Gross Motor Function Classification System (GMFCS), Manual Ability Classification System (MACS), and Communication Function Classification System (CFCS). **RESULTS:** Dystonia and choreoathetosis are simultaneously present. Median levels of dystonia (70.2%) were significantly higher than levels of choreoathetosis (26.7%) and both were significantly higher during activity than at rest (both $p < 0.01$). High correlations were found between dystonia levels and GMFCS level (Spearman's rank correlation coefficient, $r_s = 0.70$; 95% confidence interval [CI] 0.53-0.81; $p < 0.01$) and MACS ($r_s = 0.65$; 95% CI 0.47-0.81; $p < 0.01$), and fair correlation with CFCS ($r_s = 0.36$; 95% CI=0.11-0.57; $p < 0.05$). No significant correlation was found between choreoathetosis levels and motor classifications. Finally, higher choreoathetosis levels were found in participants with pure thalamus and basal ganglia lesions ($p = 0.03$) than mixed lesions, but not for dystonia ($p = 0.41$). **INTERPRETATION:** Dystonia and choreoathetosis increase during activity. However, dystonia predominates and seems to have a larger impact on functional abilities. Our findings further suggest that choreoathetosis seems to be more linked to pure thalamus and basal ganglia lesions than dystonia.

[PMID: 26173923](#)

11. Dev Med Child Neurol. 2015 Jul 14. doi: 10.1111/dmcn.12842. [Epub ahead of print]

Motor imagery in children with cerebral palsy: one step beyond with EEG dynamics.

Cheron G.

This commentary is on the original article by Jongsma et al. 'Children with unilateral cerebral palsy show diminished implicit motor imagery with the affected hand'

[PMID: 26179239](#)

12. Disabil Rehabil Assist Technol. 2015 Jul 14;1-10. [Epub ahead of print]**Application of an access technology delivery protocol to two children with cerebral palsy.**

Mumford L, Chau T.

PURPOSE: This study further delineates the merits and limitations of the Access Technology Delivery Protocol (ATDP) through its application to two children with severe disabilities. **METHOD:** We conducted mixed methods case studies to demonstrate the ATDP with two children with no reliable means of access to an external device. Evaluations of response efficiency, satisfaction, goal attainment, technology use and participation were made after 8 and 16 weeks of training with custom access technologies. **RESULTS:** After 16 weeks, one child's switch offered improved response efficiency, high teacher satisfaction and increased participation. The other child's switch resulted in improved satisfaction and switch effectiveness but lower overall efficiency. The latter child was no longer using his switch by the end of the study. **CONCLUSIONS:** These contrasting findings indicate that changes to any contextual factors that may impact the user's switch performance should mandate a reassessment of the access pathway. Secondly, it is important to ensure that individuals who will be responsible for switch training be identified at the outset and engaged throughout the ATDP. Finally, the ATDP should continue to be tested with individuals with severe disabilities to build an evidence base for the delivery of response efficient access solutions. Implications for Rehabilitation A data-driven, comprehensive access technology delivery protocol for children with complex communication needs could help to mitigate technology abandonment. Successful adoption of an access technology requires personalized design, training of the technology user, the teaching staff, the caregivers and other communication partners, and integration with functional activities.

[PMID: 26171580](#)**13. J Phys Ther Sci. 2015 Jun;27(6):2001-3. doi: 10.1589/jpts.27.2001. Epub 2015 Jun 30.****Effects of interactive games on motor performance in children with spastic cerebral palsy.**

AlSaif AA, Alsenany S.

[Purpose] Motor control and muscle strength impairments are the prime reasons for motor behavior disorders in children with spastic cerebral palsy. These impairments lead to histological changes in muscle growth and the learning of motor skills. Therefore, such children experience reduced muscle force generation and decreased muscle flexibility. We investigated the effect of training with Nintendo Wii Fit games on motor performance in children with spastic cerebral palsy. [Subjects and Methods] Forty children with cerebral palsy spastic diplegia aged 6-10 years diagnosed with level-3 functional capabilities according to the Gross Motor Classification System (GMFCS) were enrolled. Participants were divided randomly into equal groups: group (A) that practiced with the Nintendo Wii Fit game for at least 20 minutes/day for 12 weeks and group (B) that underwent no training (control group). The Movement Assessment Battery for Children-2 (mABC-2) was used to assess motor performance, because it mainly involves motor tasks very similar to those involved in playing Nintendo Wii Fit games, e.g., goal-directed arm movements, balancing, and jumping. [Results] There were significant improvements in the subscales of the motor performance test of those who practiced with the Nintendo Wii, while the control group showed no significant changes. [Conclusion] Using motion interactive games in home rehabilitation is feasible for children with cerebral palsy.

[PMID: 26180367](#)**14. Games Health J. 2015 Jun;4(3):190-4. doi: 10.1089/g4h.2014.0091. Epub 2015 Jan 23.****Active Videogaming for Individuals with Severe Movement Disorders: Results from a Community Study.**

Chung PJ, Vanderbilt DL, Schragger SM, Nguyen E, Fowler E.

OBJECTIVE: Active videogaming (AVG) has potential to provide positive health outcomes for individuals with cerebral palsy (CP), but their use for individuals with severe motor impairments is limited. Our objective was to

evaluate the accessibility and enjoyment of videogames using the Kinect™ (Microsoft, Redmond, WA) with the Flexible Action and Articulated Skeleton Toolkit (FAAST) system (University of Southern California Institute for Creative Technologies, Los Angeles, CA) for individuals with severely limiting CP. MATERIALS AND METHODS: A videogaming system was installed in a community center serving adults with CP, and a staff member was instructed in its use. Participants completed a baseline survey assessing demographics, mobility, and prior videogame experience; they then used the FAAST system with Kinect and completed a 5-point Likert survey to assess their experience. Descriptive statistics assessed overall enjoyment of the system, and Mann-Whitney U tests were conducted to determine whether responses differed by demographic factors, mobility, or prior videogame experience. RESULTS: Twenty-two subjects were recruited. The enjoyment scale demonstrated high internal consistency (Cronbach's alpha=0.88). The mean total enjoyment score was 4.24 out of 5. Median scores did not significantly differ by ethnicity, gender, CP severity, or previous videogame exposure. CONCLUSIONS: The FAAST with Kinect is a low-cost system that engages individuals with severe movement disorders across a wide range of physical ability and videogame experience. Further research should be conducted on in-home use, therapeutic applications, and potential benefits for socialization.

[PMID: 26182063](#)

15. Games Health J. 2015 Feb;4(1):31-7. doi: 10.1089/g4h.2014.0082. Epub 2014 Dec 3.

Is There Evidence That Active Videogames Increase Energy Expenditure and Exercise Intensity for People Poststroke and with Cerebral Palsy?

Deutsch JE, Guarrera-Bowlby P, Myslinski MJ, Kafri M.

This article asked and answered the question of whether there was evidence to support the use of videogames for promotion of wellness and fitness for people poststroke and those with cerebral palsy (CP). A literature search of PubMed, CINAHL, and PEDro using a population, intervention, and outcome (PIO) approach and the key words "stroke (or CP) AND video games (and synonyms) AND energy expenditure (EE) (and synonyms)" was conducted. It yielded two relevant references for people poststroke and five references for people with CP. The literature extraction and synthesis by the categories of the PIO indicated that most studies used only the population of interest, except two that compared the EE with that of healthy controls. The main finding is that both people poststroke (moderate severity) and people with CP (mild severity) can achieve moderate EE playing Wii™ (Nintendo, Kyoto, Japan), PlayStation® (Sony, Tokyo, Japan), and Kinect™ (Microsoft, Redmond, WA) games. Adults with CP of mild severity played the videogames at vigorous levels, whereas those with severe CP played them at low levels. There appears to be an interaction between development and severity that influences the exercise intensity measured by EE. The findings suggests that videogames are a gateway for wellness promotion.

[PMID: 26181678](#)

16. Games Health J. 2015 Apr;4(2):145-8. doi: 10.1089/g4h.2014.0096. Epub 2015 Feb 27.

Digital Posturography Games Correlate with Gross Motor Function in Children with Cerebral Palsy.

Bingham PM, Calhoun B.

OBJECTIVE: This pilot study aimed to assess whether performance on posturography games correlates with the Gross Motor Function Measure (GMFM) in children with cerebral palsy. MATERIALS AND METHODS: Simple games using static posturography technology allowed subjects to control screen events via postural sway. Game performance was compared with GMFMs using correlation analysis in a convenience sample of nine girls and six boys with cerebral palsy. Likert scales were used to obtain subjective responses to the balance games. RESULTS: GMFM scores correlated with game performance, especially measures emphasizing rhythmic sway. Twelve of the 15 subjects enjoyed the game and asserted an interest in playing again. CONCLUSIONS: Digital posturography games engage children with cerebral palsy in balance tasks, provide visual feedback in a balance control task, and have the potential to increase autonomy in balance control training among pediatric patients with cerebral palsy. This approach can support the relationship between child and therapist. The potential for interactive posturography to complement the assessment and treatment of balance in cerebral palsy bears continuing study.

[PMID: 26181808](#)

17. *BMC Pediatr.* 2015 Jul 15;15:75. doi: 10.1186/s12887-015-0397-5.

Predictors of caregiver depression and family functioning after perinatal stroke.

Bemister TB, Brooks BL, Dyck RH, Kirton A.

BACKGROUND: Perinatal stroke is a leading cause of cerebral palsy and lifelong neurological morbidity. Studies on perinatal stroke outcomes are increasing, although examinations of its broader impact on parents and families have been limited. A recent study found that parents of children with moderate and severe outcomes have increased risk for psychosocial concerns, including depressive symptoms and poor family functioning. Other parents adapt remarkably well, but how this occurs is unknown. The primary aim of this study was to examine predictors of parent and family outcomes, namely caregiver depression and family functioning. The secondary aim was to explore potential mediators and moderators of the relationship between condition severity and parent and family outcomes. **METHODS:** Parents were recruited from a large, population-based perinatal stroke research cohort, and they completed measures assessing their demographics, social supports, stress levels, marital quality, feelings of guilt and blame, psychological well-being, and family functioning. Bivariate analyses compared these variables. Predictor variables, mediators, and moderators were chosen according to the strength of their relationship with the outcome variables (i.e., caregiver depression and family functioning) and theory. Hierarchical regression, mediator, and moderator analyses were conducted accordingly. **RESULTS:** A total of 103 parents participated in this study (76 mothers, 27 fathers; mean age of 39.2 years; mean child age of 7.46 years). Condition severity, anxiety, social support, and blame independently predicted caregiver depression while condition severity, stress levels, and marital quality independently predicted family functioning. Blame regarding the cause of their child's condition also mediated the relationship between condition severity and caregiver depression. **CONCLUSIONS:** Adverse parental outcomes can be predicted in perinatal stroke populations. Moreover, anxiety and stress management techniques, marital support, and psychoeducation regarding the unpreventable nature of perinatal stroke may be utilized in the future to enhance family outcomes.

[PMID: 26174779](#)

18. *Dev Med Child Neurol.* 2015 Jul 15. doi: 10.1111/dmcn.12849. [Epub ahead of print]

Extrapolating published survival curves to obtain evidence-based estimates of life expectancy in cerebral palsy.

Day SM, Reynolds RJ, Kush SJ.

Studies reporting long-term survival probabilities for cohorts of persons with cerebral palsy provide evidence-based information on the life expectancy of those cohorts. Some studies have provided estimates of life expectancy based on extrapolation of such evidence, whereas many others have opted not to do so. Here we review the basic methods of life table analysis necessary for performing such extrapolations, and apply these methods to obtain evidence-based estimates of life expectancy from several studies that do not report such estimates themselves

[PMID: 26174088](#)

19. *J Pediatr Neurosci.* 2015 Apr-Jun;10(2):108-13. doi: 10.4103/1817-1745.159191.

Clinical profile, predisposing factors, and associated co-morbidities of children with cerebral palsy in South India.

Gowda VK, Kumar A, Shivappa SK, Srikanteswara PK, Shivananda, Mahadeviah MS, Govindraj M, Ramaswamy P.

INTRODUCTION: Cerebral palsy (CP) is the most common physical disorder of children. Causes like jaundice and birth injury though are decreasing; complications resulting from the survival of low birth weight babies are replacing some of the older etiologies. Hence, this study was planned. **OBJECTIVES:** The objective was to study the clinical patterns, predisposing factors, and co-morbidities in children with CP. **MATERIALS AND METHODS:** The present

study is a hospital based prospective study conducted from January 2012 to January 2013 in children presenting to neurodevelopmental clinic at a tertiary care teaching hospital in India. Hundred cases with clinical features suggestive of CP were included in the study. Cases were evaluated by history, clinical examination, and necessary investigations.

RESULTS: Results of the study showed 81% of spastic, 12% of hypotonic, 5% of dystonic, and 2% of mixed CP cases. The mean age of presentation was 2 year, 2 month, and male to female ratio of 1:2. Pregnancy-induced hypertension (PIH) was the most common antenatal complication observed in 6%. Four percent had neonatal sepsis and 19% were born premature. Associated co-morbidities were mental retardation (55%), seizure disorder (46%), visual problems (26%), hearing problems (19%), and failure to thrive (47%). **DISCUSSION:** Sex distribution observed in our study was male to female ratio of 1.2, which was comparable with a multicenter study in Europe. PIH was observed in 6% of cases, which was comparable with prior studies. Birth asphyxia was observed in 43% of cases. Eighty-one percent of the cases constituted a spastic variety of CP which was comparable to other studies. **CONCLUSION:** Perinatal asphyxia was the important etiological factor. We found preventable intranatal causes (60%) and antenatal causes (20%) forming a significant proportion. Co-morbidities were significantly observed in our study.

[PMID: 26167210](#)

Prevention and Cure

20. Am J Case Rep. 2015 Jul 17;16:469-472.

Platelet-Rich Plasma in a Patient with Cerebral Palsy.

Alcaraz J, Oliver A2, Sánchez JM.

BACKGROUND The use of platelet-rich plasma is a now a common medical technique known as regenerative medicine, through power cell activation and differentiation, which produces growth factors called platelets derived both locally and systematically. Here, we report the case of a cerebral palsy patient who received intravenous platelet-rich plasma. **CASE REPORT** We administered an intravenous injection of concentrated platelet-rich plasma (25 cc) in a 6-year-old boy with perinatal cerebral palsy, cognitive impairment, and marked and severe generalized spasticity. We performed follow-up at 3 and 6 months after the injection. All serum samples for determination were obtained by ELISA technique. Cognitive scales (Bayley, Battelle, M.S.C.A, Kaufman ABC, and Stanford-Binet Intelligence scale) were used before and after treatment. The determination protocol that was applied before the analysis was performed manually and the autotransfusion was considered suitable for treatment. We determined the plasma levels of factor similar to insulin-1 (IGF-1), platelet-derived growth factor (PDGF), vasculo-endothelial growth factor (VEGF), and transforming growth factor B (TGF-B) before and during treatment monitoring. **CONCLUSIONS** No adverse effects were observed in the patient except for a small hematoma in the area channeling venous access. We observed a clear improvement in the cognitive sphere (memory, ability to perform more complex tasks, and acquisition of new skills) and in language, maintaining stable levels of growth factor in plasma 3-5 times higher than average for his age group at both 3- and 6-month follow-up. Positron emission tomography (PET) images showed an evident increased demarcation in the cerebral cortex. We propose that this therapy is useful in these patients to harness the neurostimulative and neuroregenerative power of endogenous growth factors derived from platelets.

[PMID: 26185982](#)

21. Arch Argent Pediatr. 2015 Aug 1;113(4):345-351.

Update on the use of magnesium sulphate for fetal neuroprotection in preterm birth.

Mellen CH, Izbizky G, Otaño L.

The administration of magnesium sulphate to mothers at risk for preterm birth for fetal neuroprotection has

demonstrated to reduce the risk of cerebral palsy and gross motor dysfunction by 30-40%. Although there is controversy regarding the regimen of administration of magnesium sulphate, the gestational age limit, the extent of its potential benefit or even if it provides any benefit, current evidence is enough to support the use of magnesium sulphate in women at imminent risk for preterm delivery before 32 weeks of gestation. The objective of this study is to describe available evidence and current recommendations regarding neuroprotection with magnesium sulphate.

[PMID: 26172011](#)

22. Best Pract Res Clin Obstet Gynaecol. 2015 Jun 25. pii: S1521-6934(15)00100-5. doi: 10.1016/j.bpobgyn.2015.03.022. [Epub ahead of print]

Continuous cardiotocography during labour: Analysis, classification and management.

Pinas A, Chandraharan E.

The use of continuous intrapartum electronic fetal heart rate monitoring (EFM) using a cardiotocograph (CTG) was developed to enable obstetricians and midwives to analyse the changes of fetal heart rate during labour so as to institute timely intervention to avoid intrapartum hypoxic-ischaemic injury. Although CTG was initially developed as a screening tool to predict fetal hypoxia, its positive predictive value for intrapartum fetal hypoxia is approximately only 30%. Even though different international classifications have been developed with the aim of defining combinations of features that help predict intrapartum fetal hypoxia, the false-positive rate of the CTG is high (60%). Moreover, there has not been a demonstrable improvement in the rate of cerebral palsy or perinatal deaths since the introduction of CTG into clinical practice approximately 45 years ago. However, there has been a significant increase in intrapartum caesarean section and operative vaginal delivery rates. Unfortunately, existing guidelines employ the visual interpretation of CTG based on 'pattern recognition', which is fraught with inter- and intra-observer variability. Therefore, clinicians need to understand the physiology behind fetal heart rate changes and to respond to them accordingly, instead of purely relying on guidelines for management. It is very likely that such a 'physiology-based' approach would reduce unnecessary operative interventions and improve perinatal outcomes whilst reducing the need for 'additional tests' of fetal well-being.

[PMID: 26165747](#)

23. Ir Med J. 2015 Jun;108(6):181-2.

The Bhutani Nomogram Reduces Incidence of Severe Hyperbilirubinaemia in Term and Near Term Infants.

O'Reilly P, Walsh O, Allen NM, Corcoran JD.

Very high bilirubin levels can have devastating neurodevelopmental effects on infants including hearing loss and cerebral palsy. A previous study in our institution determined the rate of, and factors associated with, bilirubin values above exchange transfusion level. Since this study the Bhutani nomogram was introduced to help identify infants at risk of severe hyperbilirubinaemia. In our study we looked at the initial serum bilirubin taken in infants 36 weeks and 2.5 kgs. Our results show that since this nomogram was introduced there has been a significant reduction in the number of infants reaching exchange transfusion levels. We also showed that the Bhutani nomogram could successfully be used in a population of unknown direct Coombs status.

[PMID: 26182804](#)

24. J Control Release. 2015 Jul 13. pii: S0168-3659(15)30023-7. doi: 10.1016/j.jconrel.2015.07.009. [Epub ahead of print]

Systemic dendrimer-drug treatment of ischemia-induced neonatal white matter injury.

Nance E, Porambo M, Zhang F, Mishra MK, Buelow M, Getzenberg R, Johnston M, Rangaramanujam K, Fatemi A, Kannan S.

Extreme prematurity is a major risk factor for perinatal and neonatal brain injury, and can lead to white matter injury that is a precursor for a number of neurological diseases, including cerebral palsy (CP) and autism. Neuroinflammation, mediated by activated microglia and astrocytes, is implicated in the pathogenesis of neonatal brain injury. Therefore, targeted drug delivery to attenuate neuroinflammation may greatly improve therapeutic outcomes in models of perinatal white matter injury. In this work, we use a mouse model of ischemia-induced neonatal white matter injury to study the biodistribution of generation 4, hydroxyl-functionalized polyamidoamine dendrimers. Following systemic administration of the Cy5-labeled dendrimer (D-Cy5), we demonstrate dendrimer uptake in cells involved in ischemic injury, and in ongoing inflammation, leading to secondary injury. The sub-acute response to injury is driven by astrocytes. Within five days of injury, microglial proliferation and migration occurs, along with limited differentiation of oligodendrocytes and oligodendrocyte death. From one day to five days after injury, a shift in dendrimer co-localization occurred. Initially, dendrimer predominantly co-localized with astrocytes, with a subsequent shift towards microglia. Co-localization with oligodendrocytes reduced over the same time period, demonstrating a region-specific uptake based on the progression of the injury. We further show that systemic administration of a single dose of dendrimer-N-acetyl cysteine conjugate (D-NAC) at either sub-acute or delayed time points after injury results in sustained attenuation of the 'detrimental' pro-inflammatory response up to 9 days after injury, while not impacting the 'favorable' anti-inflammatory response. The D-NAC therapy also led to improvement in myelination, suggesting reduced white matter injury. Demonstration of treatment efficacy at later time points in the postnatal period provides a greater understanding of how microglial activation and chronic inflammation can be targeted to treat neonatal brain injury. Importantly, it may also provide a longer therapeutic window.

[PMID: 26184052](#)

25. J Obstet Gynaecol Res. 2015 Jul 14. doi: 10.1111/jog.12772. [Epub ahead of print]

Intrapartum risk factors for neonatal encephalopathy leading to cerebral palsy in women without apparent sentinel events.

Yamada T, Cho K, Morikawa M, Yamada T, Minakami H.

AIM: To determine intrapartum factors associated with neonatal encephalopathy leading to cerebral palsy (NE-CP). **METHODS:** A total of 70 NE-CP patients who fulfilled study criteria (cephalic singleton pregnancy with attempted vaginal delivery [AVD] at gestational week [GW] ≥ 36 ; intrapartum occurrence of non-reassuring fetal status without apparent cause following reassuring fetal status on admission; and development of NE-CP) were compared with 210 AVD controls who had 1- and 5-min Apgar score ≥ 8 matched for GW, maternal parity, and use of uterotonics. Suboptimal care was defined as delayed reaction due to misinterpretation of fetal heart rate (FHR) tracing, or inappropriate trial of instrumental delivery (TOID). Successful and failed TOID were defined as vaginal and cesarean delivery after TOID, respectively. The 210 controls were assumed not to have had suboptimal care. **RESULTS:** The rates of successful (34% vs 12%) and failed TOID (11% vs 0.0%), cesarean section (34% vs 14%), suboptimal care (57% vs 0.0%), pregnancy-induced hypertension (11% vs 2.4%), birthweight ≥ 3800 g (8.6% vs 1.9%), subgaleal hemorrhage (16% vs 0.0%) were significantly higher in NE-CP patients than in controls. Selection with the stepwise method and logistic regression analysis identified four independent risk factors for NE-CP: suboptimal intrapartum care (OR, 2.21; 95%CI: 1.99-2.47), cesarean section (OR, 1.19; 95%CI: 1.08-1.31), successful TOID (OR, 1.14; 95%CI: 1.03-1.25), and hypertension (OR, 1.20; 95%CI: 1.01-1.42). **CONCLUSIONS:** Training programs for improved interpretation of FHR tracing and appropriate TOID are required to prevent NE-CP among healthy and mature fetuses in Japan.

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