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Interventions and Management

1. **Trials. 2016 Aug 17;17(1):405. doi: 10.1186/s13063-016-1534-7.**

Transcranial direct current stimulation combined with upper limb functional training in children with spastic, hemiparetic cerebral palsy: study protocol for a randomized controlled trial.

Moura RC, Santos CA, Grecco LA, Lazzari RD, Dumont AJ, Duarte NC, Braun LA, Lopes JB, Santos LA2, Rodrigues EL, Albertini G, Cimolin V, Galli M, Oliveira CS.

BACKGROUND: The aim of the proposed study is to perform a comparative analysis of functional training effects for the paretic upper limb with and without transcranial direct current stimulation over the primary motor cortex in children with spastic hemiparetic cerebral palsy. **METHODS:** The sample will comprise 34 individuals with spastic hemiparetic cerebral palsy, 6 to 16 years old, classified at level I, II, or III of the Manual Ability Classification System. Participants will be randomly allocated to two groups: (1) functional training of the paretic upper limb combined with anodic transcranial stimulation; (2) functional training of the paretic upper limb combined with sham transcranial stimulation. Evaluation will involve three-dimensional movement analysis and electromyography using the SMART-D 140® system (BTS Engineering) and the FREEEMG® system (BTS Engineering), the Quality of Upper Extremity Skills Test, to assess functional mobility, the Portable Device and Ashworth Scale, to measure movement resistance and spasticity, and the Pediatric Evaluation of Disability Inventory, to evaluate performance. Functional reach training of the paretic upper limb will include a range of manual activities using educational toys associated with an induced constraint of the non-paretic limb during the training. Training will be performed in five weekly 20-minute sessions for two weeks. Transcranial stimulation over the primary motor cortex will be performed during the training sessions at an intensity of 1 mA. Findings will be analyzed statistically considering a 5 % significance level ($P \leq 0.05$). **DISCUSSION:** This paper presents a detailed description of a prospective, randomized, controlled, double-blind, clinical trial designed to demonstrate the effects of combining transcranial direct current stimulation over the primary motor cortex and functional training of the paretic limb in children with cerebral palsy classified at level I, II, or III of the Manual Ability Classification System. The results will be published and evidence found may contribute to the use of transcranial stimulation for this population.

[PMID: 27530758](#)

2. **Physiother Res Int. 2016 Aug 17. doi: 10.1002/pri.1674. [Epub ahead of print]**

A Single Session of Mirror-based Tactile and Motor Training Improves Tactile Dysfunction in Children with Unilateral Cerebral Palsy: A Replicated Randomized Controlled Case Series.

Auld ML, Johnston LM, Russo RN, Moseley GL.

INTRODUCTION: This replicated randomized controlled crossover case series investigated the effect of mirror-based tactile and motor training on tactile registration and perception in children with unilateral cerebral palsy (UCP). **METHODS:** Six children with UCP (6-18 years; median 10 years, five male, three-left hemiplegia, four-manual ability classification system (MACS) I, one MACS II and one MACS III) participated. They attended two 90-minute sessions - one of mirror-based

training and one of standard practice, bimanual therapy - in alternated order. Tactile registration (Semmes Weinstein Monofilaments) and perception (double simultaneous or single-point localization) were assessed before and after each session. Change was estimated using reliable change index (RCI). RESULTS: Tactile perception improved in four participants (RCI > 1.75), with mirror-based training, but was unchanged with bimanual therapy (RCI < 1.0 for all participants). Neither intervention affected tactile registration. DISCUSSION: Mirror-based training demonstrates potential to improve tactile perception in children with UCP.

[PMID: 27530980](#)

3. *Dev Med Child Neurol.* 2016 Aug 13. doi: 10.1111/dmcn.13230. [Epub ahead of print]

Should mirror movements modify therapeutic strategies for unilateral spastic cerebral palsy?

Staudt M.

[No abstract available]

[PMID: 27521274](#)

4. *Can Fam Physician.* 2016 Aug;62(8):629-32.

Early identification of motor delay: Family-centred screening tool.

Harris SR.

OBJECTIVE: To describe the Harris Infant Neuromotor Test (HINT), an infant neuromotor test using Canadian norms published in 2010 that could be used to screen for motor delay during the first year of life. QUALITY OF EVIDENCE: Extensive research has been published on the intrarater, interrater, and test-retest reliability and the content, concurrent, predictive, and known-groups validity of the HINT, as well as on the sensitivity, specificity, and positive and negative predictive values of parental concerns, as assessed by the HINT. Most evidence is level II. MAIN MESSAGE: Diagnosing motor delays during the first year of life is important because these often indicate more generalized developmental delays or specific disabilities, such as cerebral palsy. Parental concerns about their children's motor development are strongly predictive of subsequent diagnoses involving motor delay. CONCLUSION: Only through early identification of developmental motor delays, initially with screening tools such as the HINT, is it possible to provide referrals for early intervention that could benefit both the infant and the family.

[PMID: 27521388](#)

5. *Dev Neurorehabil.* 2016 Aug 18:1-8. [Epub ahead of print]

Effects of a group circuit progressive resistance training program compared with a treadmill training program for adolescents with cerebral palsy.

Aviram R, Harries N, Namourah I, Amro A, Bar-Haim S.

OBJECTIVE: To determine whether goal-directed group circuit progressive resistance exercise training (GT) can improve motor function in adolescents with cerebral palsy (CP) and to compare outcomes with a treadmill training (TT) intervention. METHODS: In a multi-centered matched pairs study, 95 adolescents with spastic CP (GMFCS II-III) were allocated to GT or TT interventions for 30 bi-weekly one hour training. Outcome measures of GMFM-66, GMFM-D%, GMFM-E%, TUG, 10 meter walk test (10 MWT), and 6 minute walk test (6 MWT) were made at baseline (T1), after interventions (T2) and 6 months post training (T3). RESULTS: Both training programs induced significant improvement in all outcome measures (T2-T1) that were mostly retained at T3. At the end of the intervention, the GT group showed an advantage in all measured changes compared to the TT group and in percentage changes. Differences were significant ($p < 0.02$) for GMFM-66, GMFM-D%, GMFM-E% and TUG. The advantage trend for the GT group was less apparent at follow up (T3-T1). CONCLUSION: Both programs were effective in improving motor function in adolescents with cerebral palsy. The GT program had generally greater

benefits based on the functional measures.

[PMID: 27536805](#)

6. Dev Neurorehabil. 2016 Aug 18:1-4. [Epub ahead of print]

Effects of a Nintendo Wii exercise program on spasticity and static standing balance in spastic cerebral palsy.

Gatica-Rojas V, Cartes-Velásquez R, Méndez-Rebolledo G, Guzman-Muñoz E, Lizama LE.

OBJECTIVE: This study sought to evaluate the effects of a Nintendo Wii Balance Board (NWBB) intervention on ankle spasticity and static standing balance in young people with spastic cerebral palsy (SCP). **METHODS:** Ten children and adolescents (aged 72-204 months) with SCP participated in an exercise program with NWBB. The intervention lasted 6 weeks, 3 sessions per week, 25 minutes for each session. Ankle spasticity was assessed using the Modified Modified Ashworth Scale (MMAS), and static standing balance was quantified using posturographic measures (center-of-pressure [CoP] measures). Pre- and post-intervention measures were compared. **RESULTS:** Significant decreases of spasticity in the ankle plantar flexor muscles ($p < 0.01$). There was also a significant reduction in the CoP sway area ($p = 0.04$), CoP mediolateral velocity ($p = 0.03$), and CoP anterior-posterior velocity ($p = 0.03$). **CONCLUSION:** A 6-session NWBB program reduces the spasticity at the ankle plantar flexors and improves the static standing balance in young people with SCP.

[PMID: 27538127](#)

7. Gait Posture. 2016 Aug 12;49:457-462. doi: 10.1016/j.gaitpost.2016.08.013. [Epub ahead of print]

Orthotic correction of lower limb function during gait does not immediately influence spinal kinematics in spastic hemiplegic cerebral palsy.

Schmid S, Romkes J, Taylor WR, Lorenzetti S, Brunner R.

BACKGROUND AND PURPOSE: Foot equinus and leg length discrepancy (LLD) are common problems in hemiplegic cerebral palsy (hCP), both causing secondary deviations of pelvic motion during gait. It can therefore be assumed that the spinal deviations observed in hCP patients are secondary as a compensation for the position of the pelvis arising from the disturbed leg function. This study investigated the effects of correcting lower extremity function by orthotics on spinal gait kinematics in hCP patients. **METHODS:** Ten adolescent hCP patients and 15 healthy controls were included. Using a validated and previously used enhanced marker set, sagittal and frontal plane spinal curvature angles as well as general trunk and lower extremity kinematics were measured while walking barefoot as well as with an orthotic correction (only hCP patients) using a 12-camera motion capture system. **RESULTS:** The hCP patients in both the barefoot and orthotic conditions indicated clinically relevant greater lumbar lordosis angles ($d \geq 0.96$, $p \leq 0.071$), smaller thoracic kyphosis angles ($d \geq 0.84$, $p \leq 0.142$) and differences in frontal plane lumbar curvature angles ($d \geq 1.00$, $p \leq 0.105$) compared to controls. However, these angles were not influenced by the successful restoration of a normal heel-to-toe gait pattern and the correction of any LLD using lower extremity orthotics. **CONCLUSIONS:** Spinal gait deviations in adolescents with mild hCP seemed not to result secondarily from foot equinus or LLD, but probably from structural deformities such as hip flexor contractures. Future research should address long-term effects of an AFO treatment as well as the relationship between spinal kinematics and severity of disease.

[PMID: 27543740](#)

8. J Biomech. 2016 Jul 26. pii: S0021-9290(16)30788-6. doi: 10.1016/j.jbiomech.2016.07.020. [Epub ahead of print]

Mechanical and material properties of the plantarflexor muscles and Achilles tendon in children with spastic cerebral palsy and typically developing children.

Theis N, Mohagheghi AA, Korff T.

BACKGROUND: Children with spastic cerebral palsy (CP) experience secondary musculoskeletal adaptations, affecting the mechanical and material properties of muscles and tendons. CP-related changes in the spastic muscle are well documented whilst less is known about the tendon. From a clinical perspective, it is important to understand alterations in tendon properties in order to tailor interventions or interpret clinical tests more appropriately. The main purpose of this study was to compare the

mechanical and material properties of the Achilles tendon in children with cerebral palsy to those of typically developing children. **METHODS:** Using a combination of ultrasonography and motion analysis, we determined tendon mechanical properties in ten children with spastic cerebral palsy and ten aged-matched typically developing children. Specifically, we quantified muscle and tendon stiffness, tendon slack length, tendon strain, cross-sectional area, Young's Modulus and the strain rate dependence of tendon stiffness. **FINDINGS:** Children with CP had a greater muscle to tendon stiffness ratio compared to typically developing children. Despite a smaller tendon cross-sectional area and greater tendon slack length, no group differences were observed in tendon stiffness or Young's Modulus. The slope describing the stiffness strain-rate response was steeper in children with cerebral palsy. **INTERPRETATION:** These results provide us with a more differentiated understanding of the muscle and tendon mechanical properties, which would be relevant for future research and paediatric clinicians.

[PMID: 27515440](#)

9. Oper Orthop Traumatol. 1999 Sep;11(3):197-210. doi: 10.1007/BF02593980.

[Transfer of the psoas tendon to the, at its origin detached, rectus femoris muscle in infantile cerebral palsy].

[Article in German]

Heimkes B, Engert K, Stotz S.

OBJECTIVES: Correction of flexion contracture of hip allowing an erect position while standing and walking. The gain in function helps to prevent a neurogenic dislocation of the coxofemoral joint. **INDICATIONS:** In infants with cerebral palsy unable to straighten the body before they can stand or walk. In ambulatory spastic children and adolescents with bothersome hip flexion contracture. **CONTRAINDICATIONS:** Severe retardation of motor development in patients with cerebral palsy in whom walking and standing cannot be anticipated. Marked spastic-dystonic muscle weakness. **SURGICAL TECHNIQUE:** In general, soft tissue releases at hip and knee are performed at the same sitting. Anterior approach to the hip. Detachment of the sartorius from the anterior superior iliac spine and mobilization in a distal direction. Detachment of the rectus femoris from the anterior inferior iliac spine and retraction distally. Exposure of the femoral nerve in the lacuna musculorum. Exposure of the psoas and detachment from the lesser tuberosity. The tendon is mobilized in a proximal direction. Transfer of the rectus tendon on the divided psoas tendon. Reattachment of the sartorius or distal displacement into the fascia of the thigh. **RESULTS:** A clinical and radiological follow-up of 71 bilaterally operated patients. A pertinent complete radiographic documentation was possible in all but 1 patient. 49.3% (n=35) of patients were able to walk preoperatively compared to 80.3% (n=57) at the time of follow-up. The average migration percentage according to Reimers amounted to 28.4% preoperatively; it had regressed to 18.2% at the time of follow-up. In none of the patients did a subluxation or dislocation occur.

[PMID: 27520345](#)

10. Oper Orthop Traumatol. 1999 Sep;11(3):213-22. doi: 10.1007/BF02593983.

[Rectus transfer in spastic diplegia].

[Article in German]

Wenz W, Döderlein L.

OBJECTIVES: Change of function of the rectus femoris through medial transfer of its distal tendon. This procedure transforms a hip flexor and knee extensor into a hip and knee flexor. Thus the muscle acts as a hip flexor during the terminal stance phase and swing phase and as a knee flexor during the swing phase. This permits the foot to clear the ground and to improve the spastic gait. **INDICATIONS:** Functional sequelae of a simultaneous spasticity of knee flexors and extensors causing a stiff gait. Isolated spasticity of rectus muscle with continuous muscle activity during stance and swing phase, recurvatum of the knee during the stance phase, limited flexion (<15°) of the knee during the swing phase and lack of clearance of the foot. **CONTRAINDICATIONS:** Pattern of global flexor spasticity. Loss of power of hip flexors. Paresis of quadriceps. **SURGICAL TECHNIQUE:** Isolation and detachment of the distal tendon of the rectus femoris. The tendon can be transferred either medially or laterally. For a medial transfer the tendon is sutured to the gracilis tendon which is detached as proximal as possible. This permits to displace the direction of pull behind the center of rotation of the knee. For a lateral transfer the tendon is sutured to the iliotibial tract. **RESULTS:** In 94,8% of patients (n=137; 274 limbs) followed for a mean of 21 months (7 to 39 months) the results were good to satisfactory using the score of Gage. The Duncan-Ely test was negative in these patients. The gait was markedly improved. Important complications did not occur.

[PMID: 27520348](#)

11. Res Dev Disabil. 2016 Aug 9;59:65-72. doi: 10.1016/j.ridd.2016.07.015. [Epub ahead of print]

Different horse's paces during hippotherapy on spatio-temporal parameters of gait in children with bilateral spastic cerebral palsy: A feasibility study.

Antunes FN, Pinho AS, Kleiner AF, Salazar AP, Eltz GD, de Oliveira Junior AA, Cechetti F, Galli M, Pagnussat AS.

Hippotherapy is often carried out for the rehabilitation of children with Cerebral Palsy (CP), with the horse riding at a walking pace. This study aimed to explore the immediate effects of a hippotherapy protocol using a walk-trot pace on spatio-temporal gait parameters and muscle tone in children with Bilateral Spastic CP (BS-CP). Ten children diagnosed with BS-CP and 10 healthy aged-matched children (reference group) took part in this study. The children with BS-CP underwent two sessions of hippotherapy for one week of washout between them. Two protocols (lasting 30min) were applied on separate days: Protocol 1: the horse's pace was a walking pace; and Protocol 2: the horse's pace was a walk-trot pace. Children from the reference group were not subjected to treatment. A wireless inertial measurement unit measured gait spatio-temporal parameters before and after each session. The Modified Ashworth Scale was applied for muscle tone measurement of hip adductors. The participants underwent the gait assessment on a path with surface irregularities (ecological context). The comparisons between BS-CP and the reference group found differences in all spatio-temporal parameters, except for gait velocity. Within-group analysis of children with BS-CP showed that the swing phase did not change after the walk pace and after the walk-trot pace. The percentage of rolling phase and double support improved after the walk-trot. The spasticity of the hip adductors was significantly reduced as an immediate result of both protocols, but this decrease was more evident after the walk-trot. The walk-trot protocol is feasible and is able to induce an immediate effect that improves the gait spatio-temporal parameters and the hip adductors spasticity.

[PMID: 27518920](#)

12. J Bone Joint Surg Am. 2016 Aug 17;98(16):1351-8. doi: 10.2106/JBJS.15.01418.

Outcomes of Cutaneous Scar Revision During Surgical Implant Removal in Children with Cerebral Palsy.

Davids JR, Diaz K, Leba TB, Adams S, Westberry DE, Bagley AM.

BACKGROUND: Children who have had surgery involving the placement of an implant frequently undergo a subsequent surgery for hardware removal. The cosmesis of surgical scars following initial and subsequent surgeries is unpredictable. Scar incision (subsequent surgical incision through the initial scar) or excision (around the initial scar) is selected on the basis of the quality of the initial scar. The outcomes following these techniques have not been determined. **METHODS:** This prospective, consecutive case series was designed to compare outcomes following surgical scar incision versus excision at the time of implant removal in children with cerebral palsy. Photographs of the scars were made preoperatively and at 6 and 12 months following implant removal and were graded for scar quality utilizing the modified Stony Brook Scar Evaluation Scale (SBSES). Parental assessment of scar appearance was performed at the same time points utilizing a visual analog cosmetic scale (VACS). **RESULTS:** The scars that were selected for incision had significantly worse SBSES scores at 6 and 12 months following the second surgery compared with preoperative values. However, parents' VACS scores of the incised scars, although worse at 6 months, were comparable with preoperative scores at 12 months. Scars that were selected for excision had significantly worse SBSES scores at 6 months but scores that were comparable with preoperative values at 12 months. VACS scores for the excised scars were comparable at the 3 time points. **CONCLUSIONS:** Surgical incisions that initially healed with good scar quality generally healed well (from the parents' perspective) following subsequent incision through the previous scar. Surgical incisions that initially healed with poor scar quality did not heal better following excision of the previous scar. In such situations, surgical excision of the existing scar should occur in conjunction with additional adjuvant therapies to improve cosmesis.

[PMID: 27535437](#)

13. J Neurol Sci. 2016 Sep 15;368:25-31. doi: 10.1016/j.jns.2016.06.029. Epub 2016 Jun 14.

Optic nerve morphology as marker for disease severity in cerebral palsy of perinatal origin.

Ghate D, Vedanarayanan V, Kamour A, Corbett JJ, Kedar S.

BACKGROUND: It is difficult to predict the neurologic outcome and ambulatory status in children with perinatal neurologic insult until 2-5years age. This study aims to correlate clinical optic nerve head (ONH) findings-cupping, pallor and hypoplasia, with gestational period and neurologic (motor) outcomes in patients with cerebral palsy (CP) from perinatal insults. **METHODS:** 54 consecutive patients with CP from perinatal insults were enrolled. Patients with intraocular disease, retinopathy of prematurity and hydrocephalus were excluded. ONH was labeled as pale, hypoplastic or large cup (cup/disc ratio \geq 0.5) if 2 ophthalmologists independently agreed after an ophthalmoscopic examination. Inter-rater reliability was excellent. **RESULTS:** Mean age at examination was 10.98 \pm 6.49years; mean gestational period was 33.26 \pm 4.78weeks. Abnormal ONH (pallor, cupping or hypoplasia) was seen in 38/54 (70%) patients. Of patients with pallor (n=17), 88% were quadriplegic and 82% non-ambulatory. Mean cup/disc ratio was 0.45 \pm 0.22; 50% patients had large cup. Multivariate logistic regression models showed that disc pallor was associated with non-ambulatory status (OR: 21.7; p=0.003) and quadriplegia (OR: 12.8; p=0.03). Large cup was associated with age at examination (OR 1.15; p=0.03). Cup/disc ratio showed positive correlation with age at examination (Pearson's r=0.39; p=0.003). There was no significant association of ONH parameters with gestational age. **CONCLUSION:** Clinically observed ONH changes (pallor, cupping and hypoplasia) are common in CP. Presence of ONH pallor serves as an indicator for poor motor outcome in patients who develop CP from perinatal causes and should prompt early referral for rehabilitation.

[PMID: 27538596](#)

14. Muscle Nerve. 2016 Aug 12. doi: 10.1002/mus.25379. [Epub ahead of print]

Skeletal muscle fiber-type specific succinate dehydrogenase activity in cerebral palsy.

Zogby AM, Dayanidhi S, Chambers HG, Schenk S, Lieber RL.

INTRODUCTION: Children with cerebral palsy (CP) exhibit increased energy expenditure during movement, but whether this is due in part to decrements in skeletal muscle mitochondrial oxidative capacity is unknown. Accordingly, we compared fiber-type specific succinate dehydrogenase (SDH) activity in children with CP to typically developing (TD) children. **METHODS:** SDH activity and myofiber areas of type 1 and 2A fibers were measured in semitendinosus biopsies of both groups (n=5/group) **Results:** SDH activity was ~35% higher in type 1 compared to type 2A fibers, but there were no differences between groups. Average myofiber area was 45% smaller in CP vs. TD (P<0.05), and type 2A fibers were 32% larger than type 1 fibers (P<0.05) only in TD children. **DISCUSSION:** Fiber-type specific SDH activity is similar between TD children and children with CP. This suggests that increased energy expenditure in children with CP is not related to impaired mitochondrial oxidative capacity. This article is protected by copyright. All rights reserved.

[PMID: 27515237](#)

15. Dev Med Child Neurol. 2016 Sep;58(9):989-90. doi: 10.1111/dmcn.13212.

The formula for health and well-being in individuals with cerebral palsy: physical activity, sleep, and nutrition.

Verschuren O, McPhee P, Rosenbaum P, Gorter JW.

[No abstract available]

[PMID: 27518536](#)

16. Dev Med Child Neurol. 2016 Sep;58(9):890. doi: 10.1111/dmcn.13208.

Nutrition, brain function, and plasticity in cerebral palsy.

Dan B.

[No abstract available]

[PMID: 27518534](#)

17. JPEN J Parenter Enteral Nutr. 2016 Aug 15. pii: 0148607116662970. [Epub ahead of print]

Caloric Requirements of Patients With Brain Impairment and Cerebral Palsy Who Are Dependent on Chronic Ventilation.

Gale R, Namestnic J, Singer P, Kagan I.

BACKGROUND AND OBJECTIVE: Israeli law mandates chronic ventilator support for children and adolescents who are severely brain impaired and show minimal responses. Feeding protocols in these cases have been based on the caloric requirements of healthy children, deducting calories for lack of activity as well as an individual adjustment according to the cerebral palsy growth curves. However, patients are still inclined to gain excessive weight. Our objective was to determine the caloric requirements of these patients. **DESIGN AND METHOD:** Sixteen patients hospitalized in a dedicated unit who were ventilated through tracheostomies and fed via gastrostomies were included. Patients were aged 3-24 years; duration of ventilation was 1-7.5 years; and diagnoses included congenital genetic or brain malformations (n = 9), hypoxic accidents (n = 4), and postbacterial or postviral encephalitis (n = 3). Resting energy expenditure (REE) was determined by indirect calorimetry. REE values were compared with the caloric requirements of age-comparable healthy children and the calories actually delivered. Data were analyzed with paired t tests, Pearson correlations, and linear regression. **RESULTS:** The REE of our patients was 46% lower than the estimated caloric requirements of healthy children. In practice, patients received 32% more calories than that measured by REE. These findings were not affected by age, weight, diagnosis, or length of hospitalization. **CONCLUSIONS:** The caloric expenditure of these patients is very low. A diet guided by indirect calorimetry is proposed to aid in providing optimal nutrition support for this unique population to avoid overfeeding and obesity.

[PMID: 27528359](#)

18. PM R. 2016 Aug 9. pii: S1934-1482(16)30824-3. doi: 10.1016/j.pmrj.2016.08.001. [Epub ahead of print]

Transition of Care in Adolescents with Cerebral Palsy: A Survey of Current Practices.

Bolger A, Vargus-Adams J, McMahon M.

BACKGROUND: Transition of care from pediatric to adult healthcare providers for youth with special needs (including cerebral palsy) is of current interest as these individuals are now living well into adulthood. Studies have attempted to identify barriers to transition, ideal timing for transition of care, and key elements for successful transition programs. These studies often encompass a wide range of diagnoses, and results cannot be fully applied to those with cerebral palsy (CP). **OBJECTIVE:** To identify and describe current transition of care (TOC) practices and beliefs among physician providers of adolescents with CP in multidisciplinary CP clinics. **DESIGN:** Descriptive Survey **SETTING:** Multidisciplinary CP clinics in the United States **PARTICIPANTS:** Physician leaders in above CP clinics **METHODS:** Respondents completed an electronic survey. Responses were de-identified and reported in aggregate using descriptive statistics. **MAIN OUTCOME MEASURE:** Electronic survey addressing three domains: demographics of clinics, current opinions/practices related to TOC processes, and perceived barriers to successful TOC. **RESULTS:** Fifteen surveys were sent with eleven returned (response rate = 73%). TOC practices varied among clinics surveyed. Fifty-five percent of clinics had a structured transition program, but only one transitioned 100% of their patients to adult providers by 22 years of age. Only one clinic had an absolute upper age limit for seeing patients, and thirty six percent of clinics accepted new patients older than 21 years. No respondent was "completely satisfied" with their transition process, and only one respondent was "moderately satisfied." The majority of respondents felt the ideal care setting for adults with CP was a comprehensive, multidisciplinary adult-focused clinic in an adult hospital/clinic with primarily adult providers. They noted the top three perceived barriers to successful TOC were limited adult providers willing to accept CP patients, concern about the level of care in the adult health care system and lack of financial resources. **CONCLUSIONS:** Current TOC practices vary considerably among multidisciplinary pediatric CP clinics and are not satisfactory to individual physician providers within these clinics. Respondents desired a multidisciplinary clinic in an adult care setting with adult

providers; however, the top three perceived barriers involved the adult health care system, making it difficult for pediatric providers to develop effective TOC programs.

[PMID: 27519825](#)

19. Dev Med Child Neurol. 2016 Aug 13. doi: 10.1111/dmcn.13229. [Epub ahead of print]

Participation trajectories: impact of school transitions on children and adolescents with cerebral palsy.

Imms C, Adair B.

AIM: To describe participation trajectories, and impact of school transitions on those trajectories, of children with cerebral palsy (CP). **METHOD:** This population-based longitudinal study assessed participation in activities outside school of children with CP born in 1994/1995. Eligible children contributed data between two and five occasions over 9 years, and had parents with sufficient English proficiency to complete the measures: the Children's Assessment of Participation and Enjoyment, and the Preferences for Activities of Children. Linear mixed models were used to assess the relationships between participation and age and the impact of transition. **RESULTS:** At study commencement (2006), 233 children with CP born in 1994/1995 were registered in Victoria; 93 (51 males, 42 females; mean age 11y 2mo, age range 10-12y) contributed longitudinal data. Participation diversity and intensity decreased over time for recreational, active physical, and self-improvement activities ($p < 0.009$). Social participation increased over time: diversity, intensity, and frequency ($p < 0.007$). All of the identified slopes were generally small ($\beta \leq 0.11$, 1-point change every 9y) except for recreational diversity scores ($\beta = -0.29$). Transition from primary and secondary school had little impact on participation. **INTERPRETATION:** Findings of increased social participation over time are encouraging. Declining participation in other activity types suggests that action is needed to ensure that meaningful recreation and leisure activities are maintained as adolescents with CP transition to adulthood.

[PMID: 27521188](#)

20. Hong Kong Med J. 2016 Aug 19. doi: 10.12809/hkmj154747. [Epub ahead of print]

Clinical transition for adolescents with developmental disabilities in Hong Kong: a pilot study.

Pin TW, Chan WL, Chan CL, Foo KH, Fung KH, Li LK, Tsang TC.

INTRODUCTION: Children with developmental disabilities usually move from the paediatric to adult health service after the age of 18 years. This clinical transition is fragmented in Hong Kong. There are no local data for adolescents with developmental disabilities and their families about the issues they face during the clinical transition. This pilot study aimed to explore and collect information from adolescents with developmental disabilities and their caregivers about their transition from paediatric to adult health care services in Hong Kong. **METHODS:** This exploratory survey was carried out in two special schools in Hong Kong. Convenient samples of adolescents with developmental disabilities and their parents were taken. The questionnaire was administered by interviewers in Cantonese. Descriptive statistics were used to analyse the answers to closed-ended questions. Responses to open-ended questions were summarised. **RESULTS:** In this study, 22 parents (mean age \pm standard deviation: 49.9 ± 10.0 years) and 13 adolescents (19.6 ± 1.0 years) completed the face-to-face questionnaire. The main diagnoses of the adolescents were cerebral palsy (59%) and cognitive impairment (55%). Of the study parents, 77% were reluctant to transition. For the 10 families who did move to adult care, 60% of the parents were not satisfied with the services. The main reasons were reluctant to change and dissatisfaction with the adult medical service. The participants emphasised their need for a structured clinical transition service to support them during this challenging time. **CONCLUSIONS:** This study is the first in Hong Kong to present preliminary data on adolescents with developmental disabilities and their families during transition from paediatric to adult medical care. Further studies are required to understand the needs of this population group during clinical transition.

[PMID: 27538386](#)

21. Dev Neurorehabil. 2016 Aug 18;1-8. [Epub ahead of print]

Gaze-based assistive technology used in daily life by children with severe physical impairments - parents' experiences.

Borgestig M, Rytterström P, Hemmingsson H.

OBJECTIVE: To describe and explore parents' experiences when their children with severe physical impairments receive gaze-based assistive technology (gaze-based assistive technology (AT)) for use in daily life. **METHODS:** Semi-structured interviews were conducted twice, with one year in between, with parents of eight children with cerebral palsy that used gaze-based AT in their daily activities. To understand the parents' experiences, hermeneutical interpretations were used during data analysis. **RESULTS:** The findings demonstrate that for parents, children's gaze-based AT usage meant that children demonstrated agency, provided them with opportunities to show personality and competencies, and gave children possibilities to develop. Overall, children's gaze-based AT provides hope for a better future for their children with severe physical impairments; a future in which the children can develop and gain influence in life. **CONCLUSION:** Gaze-based AT provides children with new opportunities to perform activities and take initiatives to communicate, giving parents hope about the children's future.

[PMID: 27537982](#)

Prevention and Cure

22. Clin Perinatol. 2016 Sep;43(3):559-72. doi: 10.1016/j.clp.2016.04.012.

Long-Term Cognitive Outcomes of Birth Asphyxia and the Contribution of Identified Perinatal Asphyxia to Cerebral Palsy.

Pappas A, Korzeniewski SJ.

Neonatal encephalopathy among survivors of presumed perinatal asphyxia is recognized as an important cause of cerebral palsy (CP) and neuromotor impairment. Recent studies suggest that moderate to severe neonatal encephalopathy contributes to a wide range of neurodevelopmental and cognitive impairments among survivors with and without CP. Nearly 1 of every 4 to 5 neonates treated with hypothermia has or develops CP. Neonatal encephalopathy is diagnosed in only approximately 10% of all cases. This article reviews the long-term cognitive outcomes of children with presumed birth asphyxia and describes what is known about its contribution to CP.

[PMID: 27524454](#)

23. Clin Perinatol. 2016 Sep;43(3):485-500. doi: 10.1016/j.clp.2016.04.007. Epub 2016 Jun 22.

Neonatal Encephalopathy: Update on Therapeutic Hypothermia and Other Novel Therapeutics.

McAdams RM, Juul SE.

Neonatal encephalopathy (NE) is a major cause of neonatal mortality and morbidity. Therapeutic hypothermia (TH) is standard treatment for newborns at 36 weeks of gestation or greater with intrapartum hypoxia-related NE. Term and late preterm infants with moderate to severe encephalopathy show improved survival and neurodevelopmental outcomes at 18 months of age after TH. TH can increase survival without increasing major disability, rates of an IQ less than 70, or cerebral palsy. Neonates with severe NE remain at risk of death or severe neurodevelopmental impairment. This review discusses the evidence supporting TH for term or near term neonates with NE.

[PMID: 27524449](#)

24. Clin Perinatol. 2016 Sep;43(3):423-38. doi: 10.1016/j.clp.2016.04.003. Epub 2016 Jun 17.

Perinatal Asphyxia from the Obstetric Standpoint: Diagnosis and Interventions.

Herrera CA, Silver RM.

Perinatal asphyxia is a general term referring to neonatal encephalopathy related to events during birth. Asphyxia refers to a deprivation of oxygen for a duration sufficient to cause neurologic injury. Most cases of perinatal asphyxia are not necessarily caused by intrapartum events but rather associated with underlying chronic maternal or fetal conditions. Of intrapartum causes, obstetric emergencies are the most common and are not always preventable. Screening high-risk pregnancies with ultrasound, Doppler velocimetry, and antenatal testing can aid in identifying fetuses at risk. Interventions such as intrauterine resuscitation or operative delivery may decrease the risk of severe hypoxia from intrauterine insults and improve long-term neurologic outcomes.

[PMID: 27524445](#)

25. Clin Perinatol. 2016 Sep;43(3):409-22. doi: 10.1016/j.clp.2016.04.002. Epub 2016 Jun 17.

Pathophysiology of Birth Asphyxia.

Rainaldi MA, Perlman JM.

The pathophysiology of asphyxia generally results from interruption of placental blood flow with resultant fetal hypoxia, hypercarbia, and acidosis. Circulatory and noncirculatory adaptive mechanisms exist that allow the fetus to cope with asphyxia and preserve vital organ function. With severe and/or prolonged insults, these compensatory mechanisms fail, resulting in hypoxic ischemic injury, leading to cell death via necrosis and apoptosis. Permanent brain injury is the most severe long-term consequence of perinatal asphyxia. The severity and location of injury is influenced by the mechanisms of injury, including degree and duration, as well as the developmental maturity of the brain.

[PMID: 27524444](#)

26. Dev Med Child Neurol. 2016 Aug 13. doi: 10.1111/dmcn.13228. [Epub ahead of print]

Does general movements quality in term infants predict cerebral palsy and milder forms of limited mobility at 6 years?

van Iersel PA, Bakker SC, Jonker AJ, Hadders-Algra M.

AIM: To evaluate in term infants associations between quality of general movements and developmental outcome in term infants at 6 years with either cerebral palsy (CP) or limited mobility without CP. **METHOD:** Participants of this prospective study were 145 term infants (86 male, 59 female). Their general movements quality was assessed at 'writhing' and 'fidgety' general movements age (3wks and 13wks post term). The assessment at 6 years consisted of a neurological examination, including assessment of minor neurological dysfunction (MND), evaluation of mobility with the Movement Assessment Battery for Children, and of behaviour and learning problems with questionnaires. **RESULTS:** Definitely abnormal general movements at writhing age were not associated with CP, whereas definitely abnormal general movements at fidgety age were (sensitivity 60%; specificity 91%; positive predictive value 19%, negative predictive value 98%). In children without CP, general movements quality was not associated with limited mobility, but it was associated to a minor extent with MND. **INTERPRETATION:** In term infants, definitely abnormal general movements at fidgety age do predict CP, but with lower accuracy than in preterm infants. General movements quality does not predict limited mobility in children without CP. The study supports suggestions that predictive value of general movements assessment in term infants is lower than that in preterm infants.

[PMID: 27521054](#)

27. Dev Med Child Neurol. 2016 Aug 13. doi: 10.1111/dmcn.13218. [Epub ahead of print]

Impact of fetal growth restriction on neurodevelopmental outcome at 2 years for extremely preterm infants: a single institution study.

El Ayoubi M, Patkai J, Bordarier C, Desfrere L, Moriette G, Jarreau PH, Zeitlin J.

AIM: We evaluated the impact of fetal growth restriction on neurodevelopmental outcomes at 2 years corrected age for infants born before 27 weeks gestational age. **METHOD:** Data on infants born before 27 weeks gestational age between 1999 and 2008 (n=463), admitted to a tertiary neonatal unit in Paris, were used to compare neurological outcomes at 2 years for infants with birthweight lower than the 10th centile and birthweight of at least the 10th centile, using intrauterine reference curves. Outcomes were cerebral palsy (CP) and the Brunet-Lézine assessment of cognitive development, which provides age-corrected overall and domain-specific (global and fine motor skills, language and social interaction) developmental quotients. Models were adjusted for perinatal and social factors. **RESULTS:** Seventy-two percent of infants were discharged alive. Eighty-three percent (n=268) were evaluated at 2 years. Six percent had CP. Fetal growth restriction was not associated with the risk of CP. After adjustment, children with a birthweight lower than the 10th centile had a global developmental quotient 4.7 points lower than those with birthweight of at least the 10th centile (p<0.001); differences were greatest for fine motor and social skills (-4.7, p=0.053 and -7.3, p<0.001 respectively). **INTERPRETATION:** In extremely preterm children, fetal growth restriction was associated with poorer neurodevelopmental outcomes at 2 years, but not with CP.

[PMID: 27520849](#)

28. Front Physiol. 2016 Aug 3;7:330. doi: 10.3389/fphys.2016.00330. eCollection 2016.

High Presence of Extracellular Hemoglobin in the Periventricular White Matter Following Preterm Intraventricular Hemorrhage.

Ley D, Romantsik O, Vallius S, Sveinsdóttir K, Sveinsdóttir S, Agyemang AA, Baumgarten M, Mörgelin M, Lutay N, Bruschetti M, Holmqvist B, Gram M.

Severe cerebral intraventricular hemorrhage (IVH) in preterm infants continues to be a major clinical problem, occurring in about 15-20% of very preterm infants. In contrast to other brain lesions the incidence of IVH has not been reduced over the last decade, but actually slightly increased. Currently over 50% of surviving infants develop post-hemorrhagic ventricular dilatation and about 35% develop severe neurological impairment, mainly cerebral palsy and intellectual disability. To date there is no therapy available to prevent infants from developing either hydrocephalus or serious neurological disability. It is known that blood rapidly accumulates within the ventricles following IVH and this leads to disruption of normal anatomy and increased local pressure. However, the molecular mechanisms causing brain injury following IVH are incompletely understood. We propose that extracellular hemoglobin is central in the pathophysiology of periventricular white matter damage following IVH. Using a preterm rabbit pup model of IVH the distribution of extracellular hemoglobin was characterized at 72 h following hemorrhage. Evaluation of histology, histochemistry, hemoglobin immunolabeling and scanning electron microscopy revealed presence of extensive amounts of extracellular hemoglobin, i.e., not retained within erythrocytes, in the periventricular white matter, widely distributed throughout the brain. Furthermore, double immunolabeling together with the migration and differentiation markers polysialic acid neural cell adhesion molecule (PSA-NCAM) demonstrates that a significant proportion of the extracellular hemoglobin is distributed in areas of the periventricular white matter with high extracellular plasticity. In conclusion, these findings support that extracellular hemoglobin may contribute to the pathophysiological processes that cause irreversible damage to the immature brain following IVH.

[PMID: 27536248](#)

29. J Clin Med Res. 2016 Sep;8(9):674-5. doi: 10.14740/jocmr2662w. Epub 2016 Jul 30.

The Necessity of Awareness of Early Symptoms of Placental Abruption Among Pregnant Japanese Women.
Suzuki S, Shinmura H.

BACKGROUND: In 2012, the recommendation for immediate contact and visit to obstetric institutions by pregnant women was emphasized by The Japan Obstetric Compensation System for Cerebral Palsy (JOCSC). In this study, we examined whether or not the increased awareness has led to the improvement of perinatal outcomes of placental abruption managed at private clinics. **METHODS:** We reviewed the obstetric records of 38 singleton pregnant women complicated by placental abruption that developed at home, and were managed at private clinics from April 2008 through April 2016. **RESULTS:** The perinatal outcomes, specifically the rate of cases with ≥ 1 hour time interval between symptom onset and clinic visit, have not changed significantly after the intervention. **CONCLUSION:** The provision of information regarding the early clinical symptoms associated with placental abruption in pregnant women has not been well documented in Japan.

[PMID: 27540442](#)

30. Zhongguo Dang Dai Er Ke Za Zhi. 2016 Aug;18(8):683-7.

[Neurodevelopmental outcomes of extremely low birth weight and very low birth weight infants and related influencing factors].

[Article in Chinese]

Zhang Q, Wu YQ, Zhuang Y, Cao J, Gao XR.

OBJECTIVE: To investigate the neurodevelopmental outcomes of extremely low birth weight (ELBW) and very low birth weight (VLBW) infants at a corrected age (CA) of 18 months and related factors influencing the outcomes. **METHODS:** The ELBW and VLBW infants who were admitted to the neonatal intensive care unit, survived, and discharged between January 2013 June 2014 were enrolled. These infants were followed up at CAs of 40 weeks and 1, 3, 6, 12, and 18 months to evaluate the neurodevelopmental outcomes. According to the neurodevelopmental status, the infants were divided into normal and abnormal neurodevelopment groups. The differences in clinical data were compared, and the risk factors for abnormal neurodevelopment in ELBW and VLBW infants were analyzed. **RESULTS:** A total of 338 ELBW and VLBW infants were enrolled, and 15 died during hospitalization. At the CA of 18 months, 145 infants (44.9%) survived and had complete follow-up data, 75 (23.2%) died, and 103 (31.9%) were lost to follow-up. Of the 145 infants who survived and had complete follow-up data, 71 (49.0%) had neurodevelopmental impairment (NDI), and 3 (2.1%) had cerebral palsy. No infants experienced visual damage with blindness in one or both eyes or hearing loss with a need for hearing aid. The logistic regression analysis showed that bronchopulmonary dysplasia (BDP) (OR=3.530, P<0.001) and sepsis (OR=2.528, P=0.035) were independent risk factors for NDI in ELBW and VLBW infants, and the incidence of NDI increased with the severity of BDP. **CONCLUSIONS:** Sepsis and BPD, especially severe BPD, are risk factors for NDI in ELBW and VLBW infants.

[PMID: 27530781](#)