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## Interventions and Management

### 1. Does Dosage Matter? A Pilot Study of Hand-Arm Bimanual Intensive Training (HABIT) Dose and Dosing Schedule in Children with Unilateral Cerebral Palsy.

Brandão MB, Mancini MC, Ferre CL, Figueiredo PRP, Oliveira RHS, Gonçalves SC, Dias MCS, Gordon AM

Phys Occup Ther Pediatr. 2017 Dec 14:1-16. doi: 10.1080/01942638.2017.1407014. [Epub ahead of print]

**AIM:** We compared the efficacy of hand-arm bimanual intensive training (HABIT) in two doses (90 vs. 45 hours) and two schedules of the same dose (90 vs. 2 × 45 hours) on hand and daily functioning.

**METHOD:** Eighteen children with unilateral cerebral palsy were randomized to receive 6 hours of daily training over 3 weeks, totaling 90 hours (Group 90, n = 9) or receive 6 hours of daily training over 1.5 weeks, totaling 45 hours (Group 2 × 45, n = 9). After 6 months, Group 2 × 45 received an additional 45 hours. Hand (Jebsen-Taylor Test of Hand Function, Assisting Hand Assessment) and daily functioning tests (Canadian Occupational Performance Measure, Pediatric Evaluation of Disability Inventory) were administered before, immediately after, and 6 months after interventions.

**RESULTS:** Both groups demonstrated significant improvements in hand and daily functioning after 90 hours (Group 90) or the first 45 hours (Group 2 × 45), without differences between groups. However, more children from Group 90 obtained smallest detectable differences in the Assisting Hand Assessment. The addition of the second bout of 45 hours (Group 2 × 45) did not lead to further improvements. **CONCLUSIONS:** As this study was powered to test for large differences between groups, future investigations on larger samples will be needed to compare differences at the two dosage levels.

[PMID: 29240518](#)

### 2. Treatment with Botulinum toxin A in a total population of children with cerebral palsy - a retrospective cohort registry study.

Franzén M, Hägglund G, Alriksson-Schmidt A.

BMC Musculoskelet Disord. 2017 Dec 11;18(1):520. doi: 10.1186/s12891-017-1880-y.

**BACKGROUND:** Botulinum toxin A (BTX-A) has been used to reduce spasticity in children with cerebral palsy (CP) for decades. The purpose of this study was to analyze to what extent BTX-A treatment was used to treat spasticity in a total population of children with CP. We investigated 1) the use of BTX-A in relation to age, sex, and Gross Motor Function Classification System (GMFCS) level, 2) the most common muscle groups treated with BTX-A in relation to the same variables, and 3) changes in the proportions of children treated with BTX-A between two time points (2010 and 2015).

**METHODS:** The study was based on data from CPUP, a combined Swedish follow-up program and national healthcare registry, comprising >95% of all children with CP in Sweden. The participants (N = 3028) were born in 2000 or later. Potential BTX-A treatment and treated muscle groups were included from all CPUP assessments recorded in the registry in 2014-2015. In Aim 3, BTX-A administration in 3-5 year-olds at two time points was assessed. Crosstabs and 95% confidence intervals (CIs) for binominal proportions were calculated and logistic regression was used to regress age, sex, and GMFCS level on BTX-A treatment. Muscle groups treated with BTX-A were assessed using crosstabs and 95% CIs. Proportional change in BTX-A treatment over a 5-year period was analyzed using chi-square. **RESULTS:** We included 3028 children (57%

boys; median age 7 years) of whom 26% received BTX-A. Significantly more boys (28%) than girls (23%) received BTX-A (OR = 1.25, [95% CI 1.05-1.48]). Significant differences were found for age and GMFCS levels; 4-6 year-olds and those at GMFCS III-IV were more likely to receive BTX-A. BTX-A treatment in the gastrocnemius muscle was most common in the 4-6 year-olds and at GMFCS I-III, whereas treatment of the hamstring and adductor muscles was more common in older children and at GMFCS IV-V. No significant change in the proportion of BTX-A administered in 2010 and 2015 was demonstrated. CONCLUSIONS: BTX-A treatment differed based on age, sex, and GMFCS level. Proportion of BTX-A treatment in Sweden has remained stable during the past five years.

[PMID: 29228927](#)

### **3. Functional electrical stimulation and ankle foot orthoses provide equivalent therapeutic effects on foot drop: A meta-analysis providing direction for future research.**

Prenton S, Hollands KL, Kenney LPJ, Onmanee P.

J Rehabil Med. 2017 Nov 17. doi: 10.2340/16501977-2289. [Epub ahead of print]

OBJECTIVE: To compare the randomized controlled trial evidence for therapeutic effects on walking of functional electrical stimulation and ankle foot orthoses for foot drop caused by central nervous system conditions. DATA SOURCES: MEDLINE, CINAHL, Cochrane Central Register of Controlled Trials, REHABDATA, PEDro, NIHR Centre for Reviews and Dissemination, Scopus and clinicaltrials.gov. STUDY SELECTION: One reviewer screened titles/abstracts. Two independent reviewers then screened the full articles. DATA EXTRACTION: One reviewer extracted data, another screened for accuracy. Risk of bias was assessed by 2 independent reviewers using the Cochrane Risk of Bias Tool. DATA SYNTHESIS: Eight papers were eligible; 7 involving participants with stroke and 1 involving participants with cerebral palsy. Two papers reporting different measures from the same trial were grouped, resulting in 7 synthesized randomized controlled trials (n= 464). Meta-analysis of walking speed at final assessment (p = 0.46), for stroke participants (p = 0.54) and after 4-6 weeks' use (p = 0.49) showed equal improvement for both devices. CONCLUSION: Functional electrical stimulation and ankle foot orthoses have an equally positive therapeutic effect on walking speed in non-progressive central nervous system diagnoses. The current randomized controlled trial evidence base does not show whether this improvement translates into the user's own environment or reveal the mechanisms that achieve that change. Future studies should focus on measuring activity, muscle activity and gait kinematics. They should also report specific device details, capture sustained therapeutic effects and involve a variety of central nervous system diagnoses.

[PMID: 29227525](#)

### **4. Changes in lower extremity strength may be related to the walking speed improvements in children with cerebral palsy after gait training.**

Hoffman RM, Corr BB, Stuberger WA, Arpin DJ, Kurz MJ.

Res Dev Disabil. 2017 Dec 12;73:14-20. doi: 10.1016/j.ridd.2017.12.005. [Epub ahead of print]

BACKGROUND: Cerebral palsy (CP) has a high probability of resulting in lower extremity strength and walking deficits. Numerous studies have shown that gait training has the potential to improve the walking abilities of these children; however, the factors governing these improvements are unknown. AIMS: This study aimed to evaluate the relationship between change in lower extremity strength, walking speed and endurance of children with CP following gait training. METHODS AND PROCEDURES: Eleven children with CP (GMFCS levels=II-III) completed a gait training protocol three days a week for six weeks. Outcome measures included a 10m fast-as-possible walk test, 6min walking endurance test and lower extremity strength. OUTCOMES AND RESULTS: The group results indicated there were improvements in walking speed, walking endurance and lower extremity strength. In addition, there was a positive correlation between percent change in lower extremity strength and walking speed and a negative correlation between the percent change in lower extremity strength and the child's age. CONCLUSIONS: Our results imply that changes in lower extremity strength might be related to the degree of the walking speed changes seen after gait training. Younger children may be more likely to show improvements in lower extremity strength after gait training.

[PMID: 29245044](#)

## 5. Hearing Loss in Pediatric Patients With Cerebral Palsy.

Weir FW, Hatch JL, McRackan TR, Wallace SA, Meyer TA.

Otol Neurotol. 2018 Jan;39(1):59-64. doi: 10.1097/MAO.0000000000001610.

**OBJECTIVE:** This study evaluates the prevalence, type, and severity of hearing impairment in children with cerebral palsy (CP) and to analyze audiologic and otologic outcomes in these patients. **STUDY DESIGN:** Retrospective analysis of the AudGen Database. **SETTING:** Tertiary academic referral center. **PATIENTS:** Pediatric patients in AudGen Database with a diagnosis of cerebral palsy. Appropriate audiologic, otologic, and demographic data were recorded. Nine hundred forty patients met inclusion criteria. Hearing loss (HL) was defined as greater than 15 dB HL at any threshold by pure tone or greater than 20 dB HL by soundfield audiometry. Other available otologic and medical conditions were documented. **RESULTS:** Of 940 patients, 367 (39%) had hearing loss. Of the 1,629 individual ears with HL, 782 (48%) had conductive, 63 (4%) had sensorineural, 410 (25%) had mixed, and 374 (23%) had unspecified hearing loss. Patients with mixed type 1 hearing loss had significantly worse PTAs. **INTERPRETATION:** Hearing loss in CP has a large degree of sensorineural loss, with a predisposition to be bilateral. The severity of hearing loss was correlated with the degree of the motor and neurologic disability in these patients.

[PMID: 29227450](#)

## 6. Cognition in childhood dystonia: a systematic review.

Coenen MA, Eggink H, Tijssen MA, Spikman JM.

Dev Med Child Neurol. 2017 Dec 14. doi: 10.1111/dmcn.13632. [Epub ahead of print]

**AIM:** Cognitive impairments have been established as part of the non-motor phenomenology of adult dystonia. In childhood dystonia, the extent of cognitive impairments is less clear. This systematic review aims to present an overview of the existing literature to elucidate the cognitive profile of primary and secondary childhood dystonia. **METHOD:** Studies focusing on cognition in childhood dystonia were searched in MEDLINE and PsychInfo up to October 2017. We included studies on idiopathic and genetic forms of dystonia as well as dystonia secondary to cerebral palsy and inborn errors of metabolism. **RESULTS:** Thirty-four studies of the initial 527 were included. Studies for primary dystonia showed intact cognition and IQ, but mild working memory and processing speed deficits. Studies on secondary dystonia showed more pronounced cognitive deficits and lower IQ scores with frequent intellectual disability. Data are missing for attention, language, and executive functioning. **INTERPRETATION:** This systematic review shows possible cognitive impairments in childhood dystonia. The severity of cognitive impairment seems to intensify with increasing neurological abnormalities. However, the available data on cognition in childhood dystonia are very limited and not all domains have been investigated yet. This underlines the need for future research using standardized neuropsychological procedures in this group.

[PMID: 29238959](#)

## 7. Comparisons of severity classification systems for oropharyngeal dysfunction in children with cerebral palsy: Relations with other functional profiles.

Goh YR, Choi JY, Kim SA, Park J, Park ES.

Res Dev Disabil. 2017 Dec 6;72:248-256. doi: 10.1016/j.ridd.2017.12.002. [Epub ahead of print]

This study aimed to investigate the relationships between various classification systems assessing the severity of oropharyngeal dysphagia and communication function and other functional profiles in children with cerebral palsy (CP). This is a prospective, cross-sectional, study in a university-affiliated, tertiary-care hospital. We recruited 151 children with CP (mean age 6.11 years, SD 3.42, range 3-18yr). The Eating and Drinking Ability Classification System (EDACS) and the dysphagia scales of Functional Oral Intake Scale (FOIS), Swallow Function Scales (SFS), and Food Intake Level Scale (FILS) were used. The Communication Function Classification System (CFCS) and Viking Speech Scale (VSS) were employed to classify communication function and speech intelligibility, respectively. The Pediatric Evaluation of Disability Inventory (PEDI) with the Gross Motor Function Classification System (GMFCS) and the Manual Ability Classification System (MACS) level were also assessed. Spearman correlation analysis to investigate the associations between measures and univariate and multivariate logistic regression models to identify significant factors were used. Median GMFCS level of participants was III (interquartile range II-IV). Significant dysphagia based on EDACS level III-V was noted in 23 children (15.2%). There were strong to very strong relationships between the EDACS level with the dysphagia scales. The EDACS presented strong associations with MACS, CFCS, and VSS, a moderate association with GMFCS level, and a moderate to strong association with each domain of the PEDI. In multivariate analysis, poor functioning in EDACS were associated with poor functioning in gross motor and communication functions.

[PMID: 29223113](#)

### 8. [Scalp acupuncture for epileptiform discharges of children with cerebral palsy].

Li S, Liu Z, Zhao W, Jin B, Li N, Luo G.

Zhongguo Zhen Jiu. 2017 Mar 12;37(3):265-268. doi: 10.13703/j.0255-2930.2017.03.012.

**OBJECTIVE:** To explore the effect of scalp acupuncture for children with cerebral palsy whose video-electroencephalogram (VEEG) showed epileptiform discharges. **METHODS:** A total of 184 children with cerebral palsy whose VEEG showed epileptiform discharges or those combined with epilepsy were randomly assigned into a combination group (99 cases) and a rehabilitation group (85 cases). All the cases were treated with the original antiepileptic drugs. The conventional physical training and massage were applied in the rehabilitation group for 3 courses with 20 d at the interval, once a day, 5 times a week and 15 times as one course. Based on the treatment as the rehabilitation group, scalp acupuncture was used in the combination group for 3 courses with 15 d at the interval, once the other day and 10 times as one course. Shenting (GV 24), Benshen (GB 13), Sishencong (EX-HN 1) were selected as the main acu points, combined with motor zone, foot motor-sensory area, balance zone, and temple-three-needle etc. Clinical onset and VEEG results were observed before and after treatment. **RESULTS:** After treatment in the combination group, 27 cases improved; 47 cases had no effect; 25 cases aggravated. While in the rehabilitation group, 11 cases improved; 46 cases had no effect; 28 cases aggravated. There was no statistically significance between the two groups ( $P>0.05$ ). As for the cases with epilepsy onset in the combination group, 8 cases improved; 4 cases had no effect; 4 cases aggravated. In the rehabilitation group, 4 cases had no effect; 7 cases aggravated. The result in the combination group was better than that in the rehabilitation group ( $P<0.05$ ). As for the cases with epileptiform discharges in the combination group, 19 cases improved; 43 cases had no effect; 21 cases aggravated. In the rehabilitation group, 11 cases improved; 42 cases had no effect; 21 cases aggravated. There was no significance between the two groups ( $P>0.05$ ). **CONCLUSIONS:** Scalp acupuncture therapy does not increase the risk of onset or epileptiform discharges in the children with cerebral palsy combined with epilepsy or epileptiform discharges. Scalp acupuncture combined with rehabilitation is better than simple rehabilitation for those with cerebral palsy and epilepsy onset.

[PMID: 29231432](#)

### 9. Ipsilesional functional recruitment within lower mu band in children with unilateral cerebral palsy, an event-related desynchronization study.

Inuggi A, Bassolino M, Tacchino C, Pippo V, Bergamaschi V, Campus C, De Franchis V, Pozzo T, Moretti P.

Exp Brain Res. 2017 Dec 11. doi: 10.1007/s00221-017-5149-3. [Epub ahead of print]

Cerebral palsy (CP) is a group of non-progressive developmental movement disorders inducing a strong brain reorganization in primary and secondary motor areas. Nevertheless, few studies have been dedicated to quantify brain pattern changes and correlate them with motor characteristics in CP children. In this context, it is very important to identify feasible and complementary tools able to enrich the description of motor impairments by considering their neural correlates. To this aim, we recorded the electroencephalographic activity and the corresponding event-related desynchronization (ERD) of a group of mild-to-moderate affected unilateral CP children while performing unilateral reach-to-grasp movements with both their paretic and non-paretic arms. During paretic arm movement execution, we found a reduced ERD in the upper  $\mu$  band (10-12.5 Hz) over central electrodes, preceded by an increased fronto-central ERD in the lower  $\mu$  band (7.5-10 Hz) during movement preparation. These changes positively correlated, respectively, with the Modified House Classification scale and the Manual Ability Classification System. The fronto-central activation likely represents an ipsilesional plastic compensatory reorganization, confirming that in not-severely affected CP, the lesioned hemisphere is able to compensate part of the damage effects. These results highlight the importance of analyzing different sub-bands within the classical mu band and suggest that in similar CP population, the lesioned hemisphere should be the target of specific intensive rehabilitation programs.

[PMID: 29230520](#)

### 10. Caring for a cerebral palsy child: a caregivers perspective at the University Teaching Hospital, Zambia.

Chiluba BC, Moyo G.

BMC Res Notes. 2017 Dec 8;10(1):724. doi: 10.1186/s13104-017-3011-0.

**BACKGROUND:** Cerebral palsy is a major cause of disability and most survivors are left with residual disability and are dependent on parents/caregivers for essential care. This study aimed to determine the experiences of parents/caregivers of cerebral palsy children receiving out-patient physiotherapy. A concurrent mixed methods was used to collect data in the present study. The modified caregiver strain index (MCSI-13) was used to detect Disturbed sleep, Inconvenient/Tiresome, Physical strain, Confining, Family changes, Changes in personal plan, Other demands, Emotional adjustments, Upsetting behavior,

Patient has changed, Work adjustments, Financial Strain and Feeling Overwhelmed (strain morbidity) in 25 parents/caregivers of CP children. A purposive sample of 25 parents/caregivers was selected for both the quantitative part and qualitative part of the study. The study was conducted at Community Based Intervention Association Out-patients at the University Teaching Hospital in Lusaka, Zambia. The MCSI was used to collect quantitative data and in-depth interviews provided the qualitative data. RESULTS: The median age of the participants was 33.6 years and a range of 27 to 50 years. The study sample consisted of more females (92%) than males (8%). being overwhelmed and inconvenient/tiresome followed by family adjustments and work adjustment 72 and 68% respectively for each were the experiences mostly highlighted by the parents/caregivers in this study. When it came to the needs of the parents/caregivers more than half of them needed help with caring. To this effect participants expressed their perception; one mother had this to say, "...I need someone to help in caring. Sometimes I need to do some other things but can't, because if I do then no one will remain with the child...".CONCLUSION: This study point out to some evidence that the burden inflicted on those caring for children with cerebral palsy should be addressed if the quality of care for those with cerebral palsy is to be improved.

[PMID: 29221493](#)

### **11. [Application of movement recognition technology in assessing spontaneous general movements in preterm infants].**

Li HH, Shan L, Wang B, Jia FY.

Zhongguo Dang Dai Er Ke Za Zhi. 2017 Dec;19(12):1306-1310.

Preterm birth is a major factor which induces neurological and motor impairments, particularly cerebral palsy, in high-risk infants. Early identification of potential neurodevelopmental impairments provides the opportunity to improve neurodevelopmental outcomes in preterm infants through early rehabilitation interventions. Clinically, the general movement assessment is a pivotal tool to predict neurodevelopmental outcomes, especially motor developmental outcomes, in high-risk infants. Movement recognition can continuously capture relevant limb movements and perform objective and quantitative assessment using computerized approaches. Various methods of recording and analyzing spontaneous general movements for infants at a risk of cerebral palsy have been extensively explored. This article summarizes the general movement assessment method and reviews the translational research on using movement recognition technology for the assessment of spontaneous general movements of preterm infants.

[PMID: 29237535](#)

### **12. [Analysis on factors for effects of motor function of cerebral palsy children assisted by acupuncture-Retrospective analysis with 520 cases attached].**

Jin B, Liu Z, Zhao Y, Zhou Y, Zhang M.

Zhongguo Zhen Jiu. 2016 Jul 12;36(7):709-714. doi: 10.13703/j.0255-2930.2016.07.009.

OBJECTIVE: To analyze the effects of motor function of cerebral palsy children by the adjuvant therapy of acupuncture and its factors retrospectively. METHODS: Five hundred and twenty cerebral palsy children in hospital (from January 2005 to December 2014) who meet the criteria were selected through Doctor Workstation of our hospital. The cases were divided into groups according to the type of cerebral palsy, gestational age, complication, treatment time and age. Based on the physical rehabilitation, all the patients were assisted by acupuncture. Scalp acupuncture was used at Zhiqizhen (seven-intelligent needles), motor area, foot-motor-sensory area, etc. Body acupuncture were mainly at the governor vessel and yangming meridians of hand and foot. Treatment was given once every other day for eight months. Effects were evaluated by gross motor function classification system (GMFCS) and gross motor function measure (GMFM). RESULTS: GMFCS: after eight-month treatment, the total effective rate of children with spastic cerebral palsy was superior to those of mixed type and involuntary movement type[77.9% (300/385) vs 60.3% (38/63), 56.9% (41/72), both  $P < 0.01$ ]. The total effective rates of the above three types with gestational age from 37 to 42 weeks were better than those of the corresponding types with gestational age ( $P < 0.01$ ,  $P < 0.05$ ). The efficacy of children with mental retardation and language disorder was higher than that of epilepsy and hearing disorder ( $P < 0.01$ ,  $P < 0.05$ ). The total effective rates of patients in the three types with the age of 1-2 were better than those of the corresponding types with the age of 2-4 (all  $P < 0.05$ ). GMFM: after three-month and eight-month treatment, the GMFM scores of the three types were increased in different degrees (all  $P < 0.01$ ), and after eight-month treatment, the score of the spastic type was increased more obviously than those of the other two types (both  $P < 0.01$ ). CONCLUSIONS: The motor function of cerebral palsy children can be improved assisted by acupuncture, and the effect may be related to treating time, cerebral palsy type, gestational age, complication and age.

[PMID: 29231410](#)

### 13. [Acupuncture based on nourishing spleen and kidney and dredging the governor vessel for motor function and ADL in children with spastic cerebral palsy].

Zhao Y, Liu Z, Jin B.

Zhongguo Zhen Jiu. 2017 Jan 12;37(1):45-48. doi: 10.13703/j.0255-2930.2017.01.010.

**OBJECTIVE:** To compare the effects of acupuncture based on nourishing spleen and kidney and dredging the governor vessel (GV) combined with rehabilitation and simple rehabilitation for children with spastic cerebral palsy. **METHODS:** One hundred and twenty patients were randomly assigned into an observation group and a control group, 60 cases in each one. Physiotherapeutics and hand function training were used in the control group for 3 sessions with 20 d at the interval, 20 times as one session, once a day. Based on the treatment of the control group, acupuncture of nourishing spleen and kidney and dredging GV was applied in the observation group for 3 sessions with 20 d at the interval, 10 times as one session, once every other day. The acupoints were Baihui (GV 20), Fengfu (GV 16), Shenzhu (GV 12), Zhiyang (GV 9), Jinsuo (GV 8), Yaoyangguan (GV 3), Mingmen (GV 4), Pishu (BL 20), Shenshu (BL 23), Zusanli (ST 36) and Sanyinjiao (SP 6). Gross motor function measure (GMFM), Peabody developmental fine motor scale and activities of daily living (ADL) scale were observed before and after treatment in the two groups. **RESULTS:** After treatment, the scores of GMFM and Peabody fine motor were apparently improved compared with those before treatment in the two groups ( $P < 0.01$ ,  $P < 0.05$ ), with better results in the observation group (both  $P < 0.05$ ). The total effective rate in the observation group was 76.7% (46/60), which was obviously better than 65.0% (39/60) in the control group ( $P < 0.05$ ). **CONCLUSIONS:** Acupuncture based on nourishing spleen and kidney and dredging the governor vessel, as an assisted method for children with spastic cerebral palsy, can effectively improve gross and fine motor functions and activities of daily living.

[PMID: 29231322](#)

## Prevention and Cure

### 14. Clemastine rescues myelination defects and promotes functional recovery in hypoxic brain injury.

Cree BAC, Niu J, Hoi KK, Zhao C, Caganap SD, Henry RG, Dao DQ, Zollinger DR, Mei F, Shen YA, Franklin RJM, Ullian EM, Xiao L, Chan JR, Fancy SPJ.

Brain. 2017 Dec 13. doi: 10.1093/brain/awx312. [Epub ahead of print]

Hypoxia can injure brain white matter tracts, comprised of axons and myelinating oligodendrocytes, leading to cerebral palsy in neonates and delayed post-hypoxic leukoencephalopathy (DPHL) in adults. In these conditions, white matter injury can be followed by myelin regeneration, but myelination often fails and is a significant contributor to fixed demyelinated lesions, with ensuing permanent neurological injury. Non-myelinating oligodendrocyte precursor cells are often found in lesions in plentiful numbers, but fail to mature, suggesting oligodendrocyte precursor cell differentiation arrest as a critical contributor to failed myelination in hypoxia. We report a case of an adult patient who developed the rare condition DPHL and made a nearly complete recovery in the setting of treatment with clemastine, a widely available antihistamine that in preclinical models promotes oligodendrocyte precursor cell differentiation. This suggested possible therapeutic benefit in the more clinically prevalent hypoxic injury of newborns, and we demonstrate in murine neonatal hypoxic injury that clemastine dramatically promotes oligodendrocyte precursor cell differentiation, myelination, and improves functional recovery. We show that its effect in hypoxia is oligodendroglial specific via an effect on the M1 muscarinic receptor on oligodendrocyte precursor cells. We propose clemastine as a potential therapy for hypoxic brain injuries associated with white matter injury and oligodendrocyte precursor cell maturation arrest.

[PMID: 29244098](#)

### 15. Intrapartum factors associated with neonatal hypoxic ischemic encephalopathy: a case-controlled study.

Torbenson VE, Tolcher MC, Nesbitt KM, Colby CE, El-Nashar SA, Gostout BS, Weaver AL, Mc Gree ME, Famuyide AO.

BMC Pregnancy Childbirth. 2017 Dec 11;17(1):415. doi: 10.1186/s12884-017-1610-3.

**BACKGROUND:** Neonatal encephalopathy (NE) affects 2-4/1000 live births with outcomes ranging from negligible neurological deficits to severe neuromuscular dysfunction, cerebral palsy and death. Hypoxic ischemic encephalopathy (HIE) is the sub cohort of NE that appears to be driven by intrapartum events. Our objective was to identify antepartum and intrapartum factors associated with the development of neonatal HIE. **METHODS:** Hospital databases were searched using relevant diagnosis codes to identify infants with neonatal encephalopathy. Cases were infants with encephalopathy and evidence of intrapartum hypoxia. For each hypoxic ischemic encephalopathy case, four controls were randomly selected from all deliveries

that occurred within 6 months of the case. RESULTS: Twenty-six cases met criteria for hypoxic ischemic encephalopathy between 2002 and 2014. In multivariate analysis, meconium-stained amniotic fluid (aOR 12.4, 95% CI 2.1-144.8,  $p = 0.002$ ), prolonged second stage of labor (aOR 9.5, 95% CI 1.0-135.3,  $p = 0.042$ ), and the occurrence of a sentinel or acute event (aOR 74.9, 95% CI 11.9-infinity,  $p < 0.001$ ) were significantly associated with hypoxic ischemic encephalopathy. The presence of a category 3 fetal heart rate tracing in any of the four 15-min segments during the hour prior to delivery (28.0% versus 4.0%,  $p = 0.002$ ) was more common among hypoxic ischemic encephalopathy cases. CONCLUSION: Prolonged second stage of labor and the presence of meconium-stained amniotic fluid are risk factors for the development of HIE. Close scrutiny should be paid to labors that develop these features especially in the presence of an abnormal fetal heart tracing. Acute events also account for a substantial number of HIE cases and health systems should develop programs that can optimize the response to these emergencies.

[PMID: 29228911](#)

## 16. Cerebral Palsy in Extremely Preterm Infants.

Hafström M, Källén K, Serenius F, Maršál K, Rehn E, Drake H, Ådén U, Farooqi A, Thorngren-Jerneck K, Strömberg B.

Pediatrics. 2017 Dec 8. pii: e20171433. doi: 10.1542/peds.2017-1433. [Epub ahead of print]

BACKGROUND AND OBJECTIVES: The risk of cerebral palsy (CP) is high in preterm infants and is often accompanied by additional neurodevelopmental comorbidities. The present study describes lifetime prevalence of CP in a population-based prospective cohort of children born extremely preterm, including the type and severity of CP and other comorbidities (ie, developmental delay and/or cognitive impairment, neurobehavioral morbidity, epilepsy, vision and hearing impairments), and overall severity of disability. In this study, we also evaluate whether age at assessment, overall severity of disability, and available sources of information influence outcome results. METHODS: All Swedish children born before 27 weeks' gestation from 2004 to 2007 were included (the Extremely Preterm Infants in Sweden Study). The combination of neonatal information, information from clinical examinations and neuropsychological assessments at 2.5 and 6.5 years of age, original medical chart reviews, and extended chart reviews was used. RESULTS: The outcome was identified in 467 (94.5%) of eligible children alive at 1 year of age. Forty-nine (10.5%) children had a lifetime diagnosis of CP, and 37 (76%) were ambulatory. Fourteen (29%) had CP diagnosed after 2.5 years of age, 37 (76%) had at least 1 additional comorbidity, and 27 (55%) had severe disability. The probability for an incomplete evaluation was higher in children with CP compared with children without CP. CONCLUSIONS: Children born extremely preterm with CP have various comorbidities and often overall severe disability. The importance of long-term follow-up and of obtaining comprehensive outcome information from several sources in children with disabilities is shown.

[PMID: 29222398](#)

## 17. Dose-dependent relationship between acidosis at birth and likelihood of death or cerebral palsy.

Kelly R, Ramaiah SM, Sheridan H, Cruickshank H, Rudnicka M, Kissack C, Becher JC, Stenson BJ.

Arch Dis Child Fetal Neonatal Ed. 2017 Dec 8. pii: fetalneonatal-2017-314034. doi: 10.1136/archdischild-2017-314034. [Epub ahead of print]

BACKGROUND: The acid-base status of infants around birth can provide information about their past, current and future condition. Although umbilical cord blood pH  $< 7.0$  or base deficit  $\geq 12$  mmol/L is associated with increased risk of adverse outcome, there is uncertainty about the prognostic value of degree of acidosis as previous studies have used different variables, thresholds, outcomes and populations. METHODS: Retrospective review of routinely collected clinical data in all live-born inborn infants of 35 weeks gestation or more delivered between January 2005 and December 2013 at the Simpson Centre for Reproductive Health, Edinburgh, UK. Infants were included if their lowest recorded pH was  $< 7$  and/or highest base deficit  $\geq 12$  mmol/L on either umbilical cord blood and/or neonatal blood gas within 1 hour of birth. Neurodevelopmental outcome of the infants with encephalopathy was collected from the targeted follow-up database. RESULTS: 56 574 infants were eligible. 506 infants (0.9%) met inclusion criteria. Poor condition at birth and all adverse outcomes increased with worsening acidosis. Combined outcome of death or cerebral palsy was 3%, 10% and 40% at lowest pH of 6.9-6.99, 6.8-6.89 and  $< 6.8$ , respectively, and 8%, 14% and 59% at a base deficit of 12-15.9, 16-19.9 and 20 mmol/L or more, respectively. CONCLUSIONS: There is a dose-dependent relationship between the degree of acidosis within an hour of delivery, and the likelihood of adverse neonatal and later neurodevelopmental outcome in infants born at 35 weeks gestation or more.

[PMID: 29222087](#)