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NEWS
Cerebral Palsy Research

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Interventions and Management

1. Is head-shaft angle a valuable continuous risk factor for hip migration in cerebral palsy?

Chougule S, Dabis J, Petrie A, Daly K, Gelfer Y.

J Child Orthop. 2016 Oct 12. [Epub ahead of print]

BACKGROUND: Reimer's migration percentage (MP) is the most established radiographic risk factor for hip migration in cerebral palsy (CP), and it assists surgical decision-making. The head-shaft angle (HSA) measures the valgus of the head and neck in relation to the shaft and may also be a useful predictor of hip migration at a young age. This study first defined normal values and investigated whether the head-shaft angle (HSA) is a continuous risk factor for hip migration in CP. METHODS: Three hundred and fifty AP pelvic radiographs of 100 consecutive children comprising the hip surveillance programme in our region were analysed for MP and HSA. Inclusion criteria were children with spastic CP and Gross Motor Function Classification System (GMFCS) levels of III-V, along with a minimum follow-up of 5 years. The mean age was 8.8 (range 3-18) years and the mean follow-up time was 7.5 (range 5-10) years. Radiographs of 103 typically developing children (TDC) were selected for the control group. The reliability of the measurements was determined. A random effects analysis was used to assess the relationship between MP and HSA for all data and for MP > 40 %. RESULTS: The TDC cohort had a mean HSA of 157.7° whilst that for the CP cohort was 161.7°. The value declined with age in both groups but remained consistently higher in the CP group. A random effects analysis considering the longitudinal data showed that there was no significant effect of HSA on MP. Similarly, when excluding CP patients with MP < 40 %, there was no significant effect of HSA on MP. CONCLUSIONS: This study found no correlation between HSA and hip migration in children with CP in this age group. Using the HSA as a routine radiographic measure in the management pathway across childhood does not offer any added value. Early enrolment onto the hip surveillance programme could offer a better prediction of hip migration using the HSA at a very young age.

PMID: 27734265

2. The relevance of nerve mobility on function and activity in children with Cerebral Palsy.

Marsico P, Tal-Akabi A, van Hedel HJ.

BMC Neurol. 2016 Oct 7;16(1):194.

BACKGROUND: In children with cerebral palsy (CP), stiffness, caused by contractile and non-contractile structures, can influence motor performance. This study sought to determine whether the nerve mobility had a relevant impact on motor performance in children with CP. We hypothesized that a positive Straight Leg Raise (SLR) test, as well as smaller SLR hip angle, would relate to lower leg muscle strength, reduced motor capacity and less motor performance in children with CP. METHODS: We applied a cross-sectional analysis on data including SLR, leg muscle strength, Gross Motor Function

Measure (GMFM-66) and number of activity counts during daily life from thirty children with CP (6-18 years). We performed receiver operating characteristics and correlation analyses. RESULTS: Positive SLR test could distinguish well between children with low versus high muscle strength and GMFM-66 scores. The SLR hip angle correlated significant with the level of disability and with muscle strength. The correlation with the GMFM-66 and the activity counts was fair. CONCLUSION: This study suggests that neural restriction of SLR is higher on functional and activity outcome than the measured SLR hip range of motion. Further studies should investigate weather improving nerve mobility can lead to an amelioration of function in children with CP.

PMID: 27717320

3. Pilot study of a targeted dance class for physical rehabilitation in children with cerebral palsy.

López-Ortiz C, Egan T, Gaebler-Spira DJ.

SAGE Open Med. 2016 Sep 23;4:2050312116670926. eCollection 2016.

INTRODUCTION: This pilot study evaluates the effects of a targeted dance class utilizing classical ballet principles for rehabilitation of children with cerebral palsy on balance and upper extremity control. METHODS: Twelve children with cerebral palsy (ages 7-15 years) with Gross Motor Function Classification scores II-IV participated in this study and were assigned to either a control group or targeted dance class group. Targeted dance class group participated in 1-h classes three times per week in a 4-week period. The Pediatric Balance Scale and the Quality of Upper Extremity Skills Test were administered before, after, and 1 month after the targeted dance class. RESULTS: Improvements in the Pediatric Balance Scale were present in the targeted dance class group in before versus after and before versus 1 month follow-up comparisons (p-value = 0.0088 and p-value = 0.019, respectively). The Pediatric Balance Scale changes were not significant in the control group. The Quality of Upper Extremity Skills Test did not reach statistical differences in either group. CONCLUSION: Classical ballet as an art form involves physical training, musical accompaniment, social interactions, and emotional expression that could serve as adjunct to traditional physical therapy. This pilot study demonstrated improvements in balance control. A larger study with a more homogeneous sample is warranted.

PMID: 27721977

4. Experience of using hippotherapy in complex effects on muscle spirals in children with spastic forms of cerebral palsy.

Strashko EY, Kapustianska AA, Bobyreva LE.

Wiad Lek. 2016;69(3 pt 2):527-529.

Matters of physical and medical rehabilitation of children with organic lesions of the nervous system, in particular, with cerebral palsy, are actual in countries around the world. Hippotherapy is neurophysiologically oriented therapy using horses. Determine whether a combination of hippotherapy as a method of rehabilitation in the aftermath of outpatient comprehensive impact on MS on a stationary phase; Study of the effect of hippotherapy as securing and preparation method for learning new postures and movements in children with spastic cerebral palsy forms; The study of the possible optimization of psychophysical state, activation motivations of patients; Determination of the optimal timing of hippotherapy sessions, the number of procedures, the study of possible fatigue factor children. HT classes were conducted at the Ippotsentra "Wind of Change" in the period 2010-2013 the main group of children surveyed (36 people) with spastic forms of cerebral palsy. HT procedure took place twice a day - morning and evening - 30 minutes during 10-12 days. Thus, the proposed integration of the HT program of complex effects on muscle spirals children with spastic cerebral palsy forms is physiologically and anthropologically based on 4-5 day training children adequately transferred the full amount of lessons learned new postures and movements, HT does not cause complications in the somatic and psycho-emotional state of the children, HT enables sensorimotor and psychomotor effects, save and normalize muscle tone for a longer period (up to three months), compared with traditional methods of physiotherapy. HT can serve as a method of learning a new "postures and movements", the preparation of the locomotor apparatus to learn walking.

PMID: 27717938

5. Cortical bone deficit and fat infiltration of bone marrow and skeletal muscle in ambulatory children with mild spastic cerebral palsy.

Whitney DG, Singh H, Miller F, Barbe MF, Slade JM, Pohlig RT, Modlesky CM.

Bone. 2016 Oct 9. pii: S8756-3282(16)30296-4. doi: 10.1016/j.bone.2016.10.005. [Epub ahead of print]

INTRODUCTION: Nonambulatory children with severe cerebral palsy (CP) have underdeveloped bone architecture, low bone strength and a high degree of fat infiltration in the lower extremity musculature. The present study aims to determine if such a profile exists in ambulatory children with mild CP and if excess fat infiltration extends into the bone marrow. MATERIALS AND METHODS: Ambulatory children with mild spastic CP and typically developing children (4 to 11years; 12/group) were tested. Magnetic resonance imaging was used to estimate cortical, medullary and total bone volume and width, bone strength [i.e., section modulus (Z) and polar moment of inertia (J)], and bone marrow fat concentration in the midtibia, and muscle volume, intermuscular, subfascial, and subcutaneous adipose tissue (AT) volume and intramuscular fat concentration in the midleg. Physical activity monitors worn on the ankle were used to assess physical activity. RESULTS: There were no group differences in age, height, body mass, body mass percentile, BMI, BMI percentile or tibia length, but children with CP had lower height percentile (19th vs. 50th percentile) and total physical activity counts (44%) than controls (both $p<0.05$). Children with CP also had lower cortical volume (30%), cortical width in the posterior (16%) and medial (32%) portion of the shaft, total bone width in the medial-lateral direction (15%), Z in the medial-lateral direction (34%), J (39%) and muscle volume (39%), and higher bone marrow fat concentration (82.1±1.8% vs. 80.5±1.9%), subfascial AT volume (3.3 fold) and intramuscular fat concentration (25.0±8.0% vs. 16.1±3.3%) than controls (all $p<0.05$). When tibia length was statistically controlled, all group differences in bone architecture, bone strength, muscle volume and fat infiltration estimates, except posterior cortical width, were still present (all $p<0.05$). Furthermore, a higher intermuscular AT volume in children with CP compared to controls emerged ($p<0.05$). CONCLUSIONS: Ambulatory children with mild CP exhibit an underdeveloped bone architecture and low bone strength in the midtibia and a greater infiltration of fat in the bone marrow and surrounding musculature compared to typically developing children. Whether the deficit in the musculoskeletal system of children with CP is associated with higher chronic disease risk and whether the deficit can be mitigated requires further investigation.

PMID: 27732905

6. Physical risk factors influencing wheeled mobility in children with cerebral palsy: a cross-sectional study.

Rodby-Bousquet E, Paleg G, Casey J, Wizert A, Livingstone R.

BMC Pediatr. 2016 Oct 10;16(1):165.

BACKGROUND: There is a lack of understanding of the factors that influence independent mobility and participation in meaningful activities. The purpose of this study was to analyse physical factors influencing independent use of manual and power wheelchairs in a total population of children with cerebral palsy (CP). METHODS: A cross-sectional study based on the most recent examination of all children with CP, born 2002-2013, reported into the Swedish cerebral palsy registry (CPUP), from January 2012 to June 2014. There were 2328 children (58 % boys, 42 % girls), aged 0-11 years, at all levels of gross motor function and hand function. Hazard ratios adjusted for age and sex were used to calculate the risk for not being able to self-propel based on Gross Motor Function Classification System (GMFCS) levels, upper extremity range of motion and hand function including Manual Ability Classification System (MACS), House functional classification system, Thumb-in-palm deformity, Zancolli (spasticity of wrist/finger flexors) and bimanual ability. RESULTS: In total 858 children used wheelchairs outdoors (692 manual, 20 power, 146 both). Only 10 % of the 838 children self-propelled manual wheelchairs, while 90 % were pushed. In contrast 75 % of the 166 children who used power mobility outdoors were independent. Poor hand function was the greatest risk factor for being unable to self-propel a manual wheelchair, while classification as GMFCS V or MACS IV -V were the greatest risk factors for not being able to use a power wheelchair independently. CONCLUSIONS: The majority of children with CP, aged 0-11 years did not self-propel manual wheelchairs regardless of age, gross motor function, range of motion or manual abilities. Power mobility should be considered at earlier ages to promote independent mobility for all children with CP who require a wheelchair especially outdoors.

PMID: 27724880

7. Do we really know what they were testing? Incomplete reporting of interventions in randomised trials of upper limb therapies in unilateral cerebral palsy.

Sakzewski L, Reedman S, Hoffmann T.

Res Dev Disabil. 2016 Oct 10;59:417-427. doi: 10.1016/j.ridd.2016.09.018. [Epub ahead of print]

BACKGROUND: Incomplete reporting of components of interventions limits uptake of evidence into clinical practice. AIMS: To evaluate the completeness of reporting of research and control interventions in randomised trials of upper limb therapies for children with unilateral cerebral palsy. METHODS AND PROCEDURES: Sixty randomized trials were included, encompassing 60 research and 68 control interventions. Using the 12-item Template for Intervention Description and Replication (TIDieR) checklist, two reviewers independently rated intervention and control descriptions. OUTCOMES AND RESULTS: When using 50% of studies as the benchmark, five of the 12 TIDieR items for the research intervention, eight of the 12 items for the control intervention and 11 of 12 items for "usual care" interventions were inadequately reported. Procedures used to deliver the research intervention were adequately reported for 63% of studies. Materials were used in 94% of research interventions, yet only 27% provided details to access/replicate materials. Training materials for interventionists were used in 38% of trials, 10 (17%) had procedure manuals, yet only 3 reported details to access materials. The location where the research intervention was provided was detailed in 65% of studies. Reporting of all items was poorer for the control intervention. CONCLUSIONS: No study adequately reported all elements on the TIDieR checklist. Details crucial for replication of interventions and interpretation of results were missing. Authors, reviewers, and editors all have a responsibility to improve the quality of intervention reporting in published trials. The TIDieR guide is a potential solution, helping to structure accounts of interventions.

PMID: 27736712

Prevention and Cure

8. Melatonin in the management of perinatal hypoxic-ischemic encephalopathy: light at the end of the tunnel?

Hendaus MA, Jomha FA, Alhammadi AH.

Neuropsychiatr Dis Treat. 2016 Sep 27;12:2473-2479. eCollection 2016.

Perinatal hypoxic-ischemic encephalopathy (HIE) affects one to three per 1,000 live full-term births and can lead to severe and permanent neuropsychological sequelae, such as cerebral palsy, epilepsy, mental retardation, and visual motor or visual perceptive dysfunction. Melatonin has begun to be contemplated as a good choice in order to diminish the neurological sequelae from hypoxic-ischemic brain injury. Melatonin emerges as a very interesting medication, because of its capacity to cross all physiological barriers extending to subcellular compartments and its safety and effectiveness. The purpose of this commentary is to detail the evidence on the use of melatonin as a neuroprotection agent. The pharmacologic aspects of the drug as well as its potential neuroprotective characteristics in human and animal studies are described in this study. Melatonin seems to be safe and beneficial in protecting neonatal brains from perinatal HIE. Larger randomized controlled trials in humans are required, to implement a long-awaited feasible treatment in order to avoid the dreaded sequelae of HIE.

PMID: 27729791

9. Respiratory distress syndrome in moderately late and late preterm infants and risk of cerebral palsy: a population-based cohort study.

Thygesen SK, Olsen M, Østergaard JR, Sørensen HT.

BMJ Open. 2016 Oct 11;6(10):e011643. doi: 10.1136/bmjopen-2016-011643.

OBJECTIVES: Infant respiratory distress syndrome (IRDS) is a known risk factor for intracerebral haemorrhage/ intraventricular haemorrhage (ICH/IVH) and periventricular leucomalacia. These lesions are known to increase the risk of cerebral palsy (CP). Thus, we wanted to examine the long-term risk of CP following IRDS in moderately late and late preterm infants. DESIGN: Population-based cohort study. SETTING: All hospitals in Denmark. PARTICIPANTS: We used nationwide

medical registries to identify a cohort of all moderately and late preterm infants (defined as birth during 32-36 full gestational weeks) born in Denmark in 1997-2007 with and without hospital diagnosed IRDS. MAIN OUTCOMES MEASURES: We followed study participants from birth until first diagnosis of CP, emigration, death or end of follow-up in 2014. We computed the cumulative incidence of CP before age 8 years and used Cox's regression analysis to compute HRs of IRDS, comparing children with IRDS to those without IRDS. HRs were adjusted for multiple covariates. RESULTS: We identified 39 420 moderately late and late preterm infants, of whom 2255 (5.7%) had IRDS. The cumulative incidence of CP was 1.9% in infants with IRDS and 0.5% in the comparison cohort. The adjusted HR of CP was 2.0 (95% CI 1.4 to 2.9). The adjusted HR of CP was 12 (95% CI 4.5 to 34) in children with IRDS accompanied by a diagnosis of ICH/IVH. After restriction to children without diagnoses of perinatal breathing disorders other than IRDS, congenital heart disease and viral or bacterial infections occurring within 4 days of birth, the overall adjusted HR was 2.1 (95% CI 1.4 to 3.1). CONCLUSIONS: The risk of CP was increased in moderately late and late preterm infants with IRDS compared with infants without IRDS born during the same gestational weeks.

PMID: 27729347

10. Imaging studies of functional neurologic disorders.

Aybek S, Vuilleumier P.

Handb Clin Neurol. 2017;139:73-84. doi: 10.1016/B978-0-12-801772-2.00007-2.

Brain imaging techniques provide unprecedented opportunities to study the neural mechanisms underlying functional neurologic disorder (FND, or conversion disorder), which have long remained a mystery and clinical challenge for physicians, as they arise with no apparent underlying organic disease. One of the first questions addressed by imaging studies concerned whether motor conversion deficits (e.g., hysteric paralysis) represent a form of (perhaps unconscious) simulation, a mere absence of voluntary movement, or more specific disturbances in motor control (such as abnormal inhibition). Converging evidence from several studies using different techniques and paradigms has now demonstrated distinctive brain activation patterns associated with functional deficits, unlike those seen in actors simulating similar deficits. Thus, patients with motor FND show consistent hypoactivation of both cortical and subcortical motor pathways, with frequent increases in other brain areas within the limbic system, but no recruitment of prefrontal regions usually associated with voluntary motor inhibition. Other studies point to a dysfunction in sensorimotor integration and agency - related to parietal dysfunction - and abnormal motor planning related to supplementary motor area and prefrontal areas. These findings not only suggest that functional symptoms reflect a genuine brain dysfunction, but also give new insights into how they are produced. However, fewer studies attempted to understand why these symptoms are produced and linked to potential psychologic or emotional risk/triggering factors. Results from such studies point towards abnormal limbic regulation with heightened emotional arousal and amygdalar activity, potentially related to engagement of defense systems and stereotyped motor behaviors, mediated by medial prefrontal cortex and subcortical structures, including the periaqueductal gray area and basal ganglia. In addition, across different symptom domains, several studies reported abnormal recruitment of ventromedial prefrontal cortex (vmPFC), a region known to regulate emotion appraisal, memory retrieval, and self-reflective representations. The vmPFC might provide important modulatory signals to both cortical and subcortical sensorimotor, visual, and even memory circuits, promoting maladaptive self-protective behaviors based on personal affective appraisals of particular events. A better understanding of such a role of vmPFC in FND may help link how and why these symptoms are produced. Further research is also needed to determine brain activation patterns associated with FND across different types of deficits and different evolution stages (e.g., acute vs. chronic vs. recovered).

PMID: 27719879

11. Association of Neurodevelopmental Outcomes and Neonatal Morbidities of Extremely Premature Infants With Differential Exposure to Antenatal Steroids.

Chawla S, Natarajan G, Shankaran S, Pappas A, Stoll BJ, Carlo WA, Saha S, Das A, Laptook AR, Higgins RD; National Institute of Child Health and Human Development Neonatal Research Network.

JAMA Pediatr. 2016 Oct 10. doi: 10.1001/jamapediatrics.2016.1936. [Epub ahead of print]

IMPORTANCE: Many premature infants are born without exposure to antenatal steroids (ANS) or with incomplete courses. This study evaluates the dose-dependent effect of ANS on rates of neonatal morbidities and early childhood neurodevelopmental outcomes of extremely premature infants. OBJECTIVE: To compare rates of neonatal morbidities and 18- to 22-month neurodevelopmental outcomes of extremely premature infants exposed to no ANS or partial or complete courses

of ANS. DESIGN, SETTING, AND PARTICIPANTS: In this observational cohort study, participants were extremely premature infants (birth weight range, 401-1000 g; gestational age, 22-27 weeks) who were born at participating centers of the National Institute of Child Health and Human Development Neonatal Research Network between January 2006 and December 2011. Data were analyzed between October 2013 and May 2016. MAIN OUTCOMES AND MEASURES: Rates of death or neurodevelopmental impairment at 18 to 22 months' corrected age. Neurodevelopmental impairment was defined as the presence of any of the following: moderate to severe cerebral palsy, a cognitive score less than 85 on the Bayley Scales of Infant and Toddler Development III, blindness, or deafness. RESULTS: There were 848 infants in the no ANS group, 1581 in the partial ANS group, and 3692 in the complete ANS group; the mean (SD) birth weights were 725 (169), 760 (173), and 753 (170) g, respectively, and the mean (SD) gestational ages were 24.5 (1.4), 24.9 (2), and 25.1 (1.1) weeks. Of 6121 eligible infants, 4284 (70.0%) survived to 18- to 22-month follow-up, and data were available for 3892 of 4284 infants (90.8%). Among the no, partial, and complete ANS groups, there were significant differences in the rates of mortality (43.1%, 29.6%, and 25.2%, respectively), severe intracranial hemorrhage among survivors (23.3%, 19.1%, and 11.7%), death or necrotizing enterocolitis (48.1%, 37.1%, and 32.5%), and death or bronchopulmonary dysplasia (74.9%, 68.9%, and 65.5%). Additionally, death or neurodevelopmental impairment occurred in 68.1%, 54.4%, and 48.1% of patients in the no, partial, and complete ANS groups, respectively. Logistic regression analysis revealed that complete (odds ratio, 0.63; 95% CI, 0.53-0.76) and partial (odds ratio, 0.77; 95% CI, 0.63-0.95) ANS courses were associated with lower rates of death or neurodevelopmental impairment compared with the no ANS group. The reduction in the rate of death or neurodevelopmental impairment associated with exposure to a complete ANS course may be mediated through a reduction in rates of severe intracranial hemorrhage and/or cystic periventricular leukomalacia in the neonatal period. CONCLUSIONS AND RELEVANCE: Antenatal steroid exposure was associated with a dose-dependent protective effect against death or neurodevelopmental impairment in extremely preterm infants. The effect was partly mediated by ANS-associated reductions in rates of severe intracranial hemorrhage and/or cystic periventricular leukomalacia. These results support prompt administration of ANS, with the goal of a complete course prior to delivery.

PMID: 27723868