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Interventions and Management

1. J Child Neurol. 2013 Apr 12. [Epub ahead of print]

Further Evaluation of the Scoring, Reliability, and Validity of the Hypertonia Assessment Tool (HAT)

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We assessed the impact of videotape analysis on scoring of the Hypertonia Assessment Tool (HAT) that discriminates between hypertonia subtypes. The HAT was administered to 28 children with cerebral palsy (mean age 9 years, range 4-17 years, 61% male). HAT examinations were videotaped; scores were assigned before and after videotape review. Neurological examination provided the gold standard diagnosis. Interrater reliability, criterion validity and individual item validation were assessed using prevalence and bias-adjusted kappa (PABAK). Videotape review did not significantly change the HAT item scores or diagnoses. Item validation eliminated 1 dystonia item. Interrater reliability was moderate for dystonia (PABAK = 0.43) and excellent for spasticity and rigidity (PABAK = 0.86-1.0). Criterion validity was substantial for spasticity (PABAK = 0.71), moderate for dystonia (PABAK = 0.43-0.57) and excellent for the absence of rigidity (PABAK = 1.0). The HAT can be administered without videotape review. Dystonia item 1 did not change the HAT hypertonia diagnosis and will be removed from the HAT.

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2. Dev Med Child Neurol. 2013 Apr 17. doi: 10.1111/dmcn.12153. [Epub ahead of print]

Validity and clinimetric properties of the Spinal Alignment and Range of Motion Measure in children with cerebral palsy.

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AIM: The aim of this study was to assess the validity, responsiveness, and clinimetric properties of the Spinal Alignment and Range of Motion Measure (SAROMM) in children with cerebral palsy (CP). METHOD: Sixty-two

children with CP (40 males, 22 females) with a median age of 3 years and 11 months (range 1-6y) and their caregivers participated in this study. Among the children, 56 had spastic CP while six had non-spastic CP; 53 had bilateral CP, while nine had unilateral limb involvement. Thirty-three children were classified as Gross Motor Function Classification System (GMFCS) levels I to III and 23 as levels IV or V. Fifty-six children (90%) received regular rehabilitation by means of regular physical or occupational therapy (50% once or twice per week and 40% more than two times per week) and six children (10%) received irregular rehabilitation (less than once a week). Construct validity was determined by assessing the strength of the correlation between the spinal alignment SAROMM (SAROMM-SA), the range of motion SAROMM (SAROMM-ROM), and the total SAROMM (SAROMM-total), and construct measures, including the 66-item Gross Motor Function Measure (GMFM-66) and Functional Independence Measures for Children (WeeFIM), at baseline and at 6-months follow-up. Responsiveness was examined using effect size. Minimal detectable change (MDC) at the 90% confidence level (MDC90) and minimal clinically important difference (MCID) were analysed. RESULTS: The SAROMM with the GMFM-66 and WeeFIM had fair to good construct validity. The effect size values of all SAROMM scales were 0.24 to 0.48. The MDC90 values and MCID range were 1.43 and 0.47 to 1.67 for the SAROMM-SA, 3.12 and 3.68 to 4.07 for the SAROMM-ROM, and 3.22 and 4.53 to 4.62 for the SAROMM-total. INTERPRETATION: The clinimetric properties of the SAROMM allow clinicians to determine whether a change in SAROMM score represents a clinically meaningful change.

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3. Rev Esp Cir Ortop Traumatol. 2012 Jul-Aug;56(4):306-12. doi: 10.1016/j.recot.2012.03.001. Epub 2012 May 23.

Bone mineral density in a population with severe infantile cerebral palsy [Article in Spanish]

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OBJECTIVE: To determine the bone mineral density (BMD) values in children and adolescents with moderate and severe infantile cerebral palsy (ICP) in our catchment area, and compare these values with a healthy population. MATERIAL AND METHOD: A prognostic study of cases and controls for the assessment of BMD in patients from 2 to 18 years old with infantile cerebral palsy belonging to the Gross Motor Function Classification System (GMFCS) Groups IV and V. The BMD measurements were performed at distal femur level, dividing this region into 3 areas following the forearm protocol. RESULTS: The BMD for each of the three areas studied results in the final sample of 69 patients were much lower than the reference levels. There was a statistically significant difference ($P < .05$) between the BMD values in the two sub-groups studied. DISCUSSION: The greater the involvement, from a neurological point of view, in patients classified as Group V shows a very low BMD compared to patients of similar sex and age. The acquisition of bone capital in patients with ICP does not follow the normal pattern of the healthy population.

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4. Res Dev Disabil. 2013 Apr 11;34(6):2023-2032. doi: 10.1016/j.ridd.2013.03.021. [Epub ahead of print]

Sit-to-stand movement in children with hemiplegic cerebral palsy: Relationship with knee extensor torque and social participation.

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This study aimed to investigate the relationship between sit-to-stand (STS) movement, knee extensor torque and

social participation in children with cerebral palsy (CP). Seven spastic hemiplegic CP patients (8.0±2.2 years), classified by the Gross Motor Function Classification System as I and II, and 18 typical children (8.4±2.3 years) participated in this study. Trunk, hips, knees, and ankles angles and temporal variables of STS movement were obtained by means of kinematics evaluation. Isokinetic evaluation was performed at 60°/s in the concentric passive mode to measure knee extensors torque. Social participation was assessed by the Assessment of Life Habits for Children (LIFE-H) scale. Results showed that children with spastic hemiplegic CP have lower knee extensor torque in the affected limb and restriction in social participation in dimensions related with fine motor control and language skills when compared to their typical peers. Except for ankle excursion in frontal plane, and ankle excursion and range in transverse plane, patients were similar to typical children regarding the strategies adopted to perform the STS movement, as well as in the participation dimensions related with gross motor function. Moreover, we found a significant non-linear correlation between knee extensors torque and some lower limb and trunk angles for children with CP. Therefore, during evaluation and rehabilitation processes, impairments in body functions and structures should be related with how much they affect a child's ability to perform functional activities, so rehabilitation protocols could be focused on individual needs.

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5. Dev Med Child Neurol. 2013 Apr 17. doi: 10.1111/dmcn.12151. [Epub ahead of print]

The use of the Spinal Alignment and Range of Motion Measure with children and young people with cerebral palsy.

Bartlett DJ.

School of Physical Therapy, Western University, London, Ontario, Canada.

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6. Disabil Rehabil. 2013 Apr 17. [Epub ahead of print]

Gait function and decline in adults with cerebral palsy: a systematic review.

Morgan P, McGinley J.

Physiotherapy Department, Monash University, Frankston, Australia and.

Purpose: The aim of this systematic review was to identify, appraise and synthesize the evidence describing gait decline in adults with cerebral palsy (CP). **Method:** Comprehensive searches were conducted in MEDLINE (1970-), EMBASE (1980-), CINAHL (1982-) and AMED (1985-) databases to June 2012. Two reviewers independently completed data extraction and analysis using a modified version of the Downs and Black quality tool. **Results:** From the 485 papers identified, 16 met the inclusion criteria. Most studies used samples of convenience. The reported mean ages of the study groups varied from 22 to 42.6 years. Decline in gait function was measured variably with the period of decline undefined or from an unknown reference time during childhood. Results suggest that mobility decline occurs in 25% or more of adults with CP. Those at higher risk of gait decline are those with worse initial gait ability, bilateral rather than unilateral motor impairment, older age and higher levels of pain or fatigue. **Conclusion:** Many ambulant adults with CP experience mobility decline earlier than their nondisabled peers. More information regarding the natural history of mobility change over the lifespan in adults with CP augmented with self-efficacy qualitative data is needed to direct health advice and appropriate interventions for this group. **Implications for Rehabilitation** The literature suggests 25% or more of ambulant adults with cerebral palsy experience gait decline. Higher risk of gait decline occurs in those who are older, less independent in gait, have bilateral motor impairment and higher levels of pain or fatigue. Use of standardized gait measurement tools augmented with self-efficacy measures will aid provision of health advice and interventions.

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7. Chin J *Physiol.* 2013 Apr 30;56(2). pii: CJP.2013.BAA087. doi: 10.4077/CJP.2013.BAA087. [Epub ahead of print]

Associated Reactions during a Visual Pursuit Position Tracking Task in Hemiplegic and Quadriplegic Cerebral Palsy.

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Most previous studies of associated reactions (ARs) in people with cerebral palsy have used observation scales, such as recording the degree of movement through observation. The sensitive quantitative method can detect ARs that are not amply visible. The aim of this study was to provide quantitative measures of ARs during a visual pursuit position tracking task. Twenty-three hemiplegia (H) (mean \pm SD: 21y 8m \pm 11y 10m), twelve quadriplegia (Q) (21y 5m \pm 10y 3m) and twenty-two subjects with normal development (N) (21y 2m \pm 10y 10m) participated in the study. An upper limb visual pursuit tracking task was used to study ARs. The participants were required to follow a moving target with a response cursor via elbow flexion and extension movements. The occurrence of ARs was quantified by the overall coherence between the movements of tracking and non-tracking limbs and the amount of movement due to ARs was quantified by the amplitude of movement the non-tracking limbs. The amplitude of movement of the non-tracking limb indicated that the amount of ARs was larger in the Q group than the H and N groups with no significant differences between the H and N groups. The amplitude of movement of the non-tracking limb was larger during non-dominant than dominant tracking in all three groups. Some movements in the non-tracking limb were correlated with the tracking limb (correlated ARs) and some movements that were not correlated with the tracking limb (uncorrelated ARs). The correlated ARs comprised less than 40% of the total ARs for all three groups. Correlated ARs were negatively associated with clinical evaluations, but not the uncorrelated ARs. The correlated and uncorrelated ARs appear to have different relationships with clinical evaluations, implying the effect of ARs on upper limb activities could be varied.

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8. *Disabil Rehabil Assist Technol.* 2013 Apr 18. [Epub ahead of print]

The nature of arm movement in children with cerebral palsy when using computer-generated exercise games.

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Purpose: To compare upper limb kinematics of children with spastic cerebral palsy (CP) using a passive rehabilitation joystick with those of adults and able-bodied children, to better understand the design requirements of computer-based rehabilitation devices. Method: A blocked comparative study involving seven children with spastic CP, nine able-bodied adults and nine able-bodied children, using a joystick system to play a computer game whilst the kinematics of their upper limb were recorded. The translational kinematics of the joystick's end point and the participant's shoulder movement (protraction/retraction) and elbow rotational kinematics (flexion/extension) were analysed for each group. Results: Children with spastic CP matched their able-bodied peers in the time taken to complete the computer task, but this was due to a failure to adhere to the task instructions of travelling along a prescribed straight line when moving between targets. The spastic CP group took longer to initiate the first movement, which showed jerkier trajectories and demonstrated qualitatively different movement patterns when using the joystick, with shoulder movements that were significantly of greater magnitude than the able-bodied participants. Conclusions: Children with spastic CP generate large shoulder and hence trunk movements when using a joystick to undertake computer-generated arm exercises. This finding has implications for the development and use of assistive technologies to encourage exercise and the instructions given to users of such systems. Implications for Rehabilitation A kinematic analysis of upper limb function of children with CP when using joystick devices is presented. Children with CP may use upper body movements to compensate for limitations in voluntary shoulder and elbow movements when undertaking computer games designed to encourage the practice of arm movement. The design of rehabilitative computer exercise systems should consider movement of the torso/shoulder as it may have implications for the quality of therapy in the rehabilitation of the upper limb in children with CP.

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9. Res Dev Disabil. 2013 Apr 9;34(6):1891-1896. doi: 10.1016/j.ridd.2013.03.008. [Epub ahead of print]

Motor learning of a bimanual task in children with unilateral cerebral palsy.

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Children with unilateral cerebral palsy (CP) have been shown to improve their motor performance with sufficient practice. However, little is known about how they learn goal-oriented tasks. In the current study, 21 children with unilateral CP (age 4-10 years old) and 21 age-matched typically developed children (TDC) practiced a simple bimanual speed stack task over 15 days of practice. Both groups demonstrated their ability to learn the current bimanual task, but their rate of improvement and learning pattern differed. Children with unilateral CP overall were slower and improved ~10% less than TDC. Most of the improvement occurred during the first 3 days for the TDC, whereas performance did not plateau until 6-8 days for the children with unilateral CP. This initial slower learning rate for children with unilateral CP was also confirmed by better fitting of the curve to an exponential function than the power law function ($p < 0.05$). Therefore, when working with children with unilateral CP, sufficient practice is important (two to three times more than for TDC), and delayed improvement is expected.

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10. Res Dev Disabil. 2013 Apr 11;34(6):1928-1937. doi: 10.1016/j.ridd.2013.03.020. [Epub ahead of print]

Effect of observation of simple hand movement on brain activations in patients with unilateral cerebral palsy: an fMRI study.

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The aim of this functional magnetic resonance imaging (fMRI) study was to examine and compare brain activation in patients with unilateral cerebral palsy (CP) during observation of simple hand movement performed by the paretic and nonparetic hand. Nineteen patients with clinical unilateral CP (14 male, mean age 14 years, 7-21 years) participated in the study. Hand motor impairment was assessed using the sequential finger opposition task. Using fMRI block design, brain activation was examined following observation at rest of a simple opening-closing hand movement, performed by either the left or right hand of an actor. Eighteen fMRI datasets were analyzed. Observing hand movement produced large bilateral activations in temporo-parieto-fronto-occipital network, comprising most of the nodes of the well described action-observation network. For either side, observing hand movements recruits the primary motor cortex (M1), contralateral to the viewed hand, as would be expected in healthy persons. Viewing movement performed by an actor's hand representing the paretic side of patients activated more strongly ipsilesional M1 than viewing movement performed by an actor's hand representing the nonparetic side of patients. Observation of hand movement in patients with CP engaged the motor execution network regardless of the degree of motor impairment.

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11. Disabil Rehabil Assist Technol. 2013 Apr 18. [Epub ahead of print]**Technical devices in children with motor disabilities: a review.**

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Research Group in Physiotherapy and Health Promotion, Regional Campus of International Excellence "Campus Mare Nostrum", Murcia University, Espinardo-Murcia, Murcia, Spain.

Purpose: To assess the effectiveness of technical devices used in children with motor disabilities. **Method:** A systematic search of CINAHL Plus, EMBASE, PEDro, Cochrane Library, Isi Web of Knowledge and Scifinder Web was carried out, covering the period between January 2000 and January 2012. The inclusion criteria were: (1) Studies involving a minimum of five children (randomized-clinical trials with control group and experimental group, clinical trials without control group and prospective cohort studies); (2) age range, 0 to 18 years. The methodological quality of the included studies was assessed by the two authors through the application of the PEDro scale. **Results:** Of the 59 articles identified by the search strategy, 27 articles were considered eligible. The most frequently evaluated devices were ankle and foot orthoses and the most studied pathology was cerebral palsy. The mean score on the PEDro scale was 6.8. **Conclusions:** The methodological quality of studies needs to be improved and more rigorous research designs should be followed that will allow the effectiveness and quality of movement to be assessed. The satisfaction of the patient and family with the devices should be analyzed in future studies. **Implications for Rehabilitation** The study adds an analysis of studies to determine the effectiveness of technical devices in children with motor disabilities and proposals for future studies to assess the long-term outcomes and improve the quality of interventions. Therefore, this review proposes to identify: The main technical device used in children with motor disability. Which types of pathology or motor disorders require technical devices to be used and what devices are available. The effects on the child of wearing technical devices. The measurements used to determine the effectiveness of technical aids.

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12. Arch Phys Med Rehabil. 2013 Apr 11. pii: S0003-9993(13)00286-4. doi: 10.1016/j.apmr.2013.03.025. [Epub ahead of print]**Relationship between communication skills and gross motor function in preschool-aged children with cerebral palsy.**

Coleman A, Weir KA, Ware RS, Boyd RN.

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OBJECTIVE: To explore the communication skills of children with cerebral palsy (CP) at 24 months corrected-age with reference to typically developing children, and to determine the relationship between communication ability, gross motor function and other comorbidities associated with CP. **DESIGN:** Prospective, cross-sectional, population based cohort study. **SETTING:** General community. **PATIENTS:** 124 children with CP, mean age 24 months, functional severity on Gross Motor Function Classification System (GMFCS): I=47, II=14, III=22, IV=19, V=22. **INTERVENTIONS:** Not applicable. **MAIN OUTCOME MEASURE:** Parents reported communication skills on the Communication and Symbolic Behavior Scales Developmental Profile (CSBS-DP) Infant-Toddler Checklist. Two independent physiotherapists classified motor type, distribution and GMFCS. Data on comorbidities were obtained from parent interview and medical records. **RESULTS:** Children with mild CP (GMFCS I/II) had mean CSBS-DP scores that were 0.5-0.6 SD below the mean for typically developing peers, while those with moderate-severe impairment (GMFCS III-V) were 1.4-2.6 below the mean. GMFCS was significantly associated with performance on the CSBS-DP ($F = 18.55, p < 0.001$), with gross motor ability accounting for 38% of the variation in communication. Poorer communication was strongly associated with gross motor function and full-term birth. **CONCLUSION:** Preschool-aged children with CP, with more severe gross motor impairment, showed delayed communication, while children with mild motor impairment were less vulnerable. Term-born children had significantly poorer communication than those born prematurely. As a portion of each gross motor functional severity level are at risk, this study reinforces the need for early monitoring of communication development for all children with CP.

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13. Pediatrics. 2013 Apr 15. [Epub ahead of print]

Oropharyngeal Dysphagia and Gross Motor Skills in Children With Cerebral Palsy.

Benfer KA, Weir KA, Bell KL, Ware RS, Davies PS, Boyd RN.

Queensland Cerebral Palsy and Rehabilitation Research Centre, School of Medicine.

OBJECTIVES: To determine the prevalence of oropharyngeal dysphagia (OPD) and its subtypes (oral phase, pharyngeal phase, saliva control), and their relationship to gross motor functional skills in preschool children with cerebral palsy (CP). It was hypothesized that OPD would be present across all gross motor severity levels, and children with more severe gross motor function would have increased prevalence and severity of OPD. **METHODS:** Children with a confirmed diagnosis of CP, 18 to 36 months corrected age, born in Queensland between 2006 and 2009, participated. Children with neurodegenerative conditions were excluded. This was a cross-sectional population-based study. Children were assessed by using 2 direct OPD measures (Schedule for Oral Motor Assessment; Dysphagia Disorders Survey), and observations of signs suggestive of pharyngeal phase impairment and impaired saliva control. Gross motor skills were described by using the Gross Motor Function Measure, Gross Motor Function Classification System (GMFCS), Manual Ability Classification System, and motor type/ distribution. **RESULTS:** OPD was prevalent in 85% of children with CP, and there was a stepwise relationship between OPD and GMFCS level. There was a significant increase in odds of having OPD, or a subtype, for children who were nonambulant (GMFCS V) compared with those who were ambulant (GMFCS I) (odds ratio = 17.9, P = .036). **CONCLUSIONS:** OPD was present across all levels of gross motor severity using direct assessments. This highlights the need for proactive screening of all young children with CP, even those with mild impairments, to improve growth and nutritional outcomes and respiratory health.

[PMID: 23589816](#) [PubMed - as supplied by publisher]

14. Interventions for Feeding and Nutrition in Cerebral Palsy [Internet].

Ferluga ED, Archer KR, Sathe NA, Krishnaswami S, Klint A, Lindegren ML, McPheeters ML.

Rockville (MD): Agency for Healthcare Research and Quality (US); 2013 Mar. Report No.: 13-EHC015-EF.

AHRQ Comparative Effectiveness Reviews.

OBJECTIVES: The Vanderbilt Evidence-based Practice Center examined the effects of available interventions for feeding and nutrition problems that have been evaluated in individuals with cerebral palsy (CP). **DATA SOURCES:** MEDLINE® via the PubMed® interface, PsycINFO® (psychology and psychiatry literature), the Educational Resources Information Clearinghouses, OTSeeker, REHABDATA, and the Cumulative Index of Nursing and Allied Health Literature (CINAHL®) database. Additional studies were identified from reference lists and technical experts. **REVIEW METHODS:** We reviewed studies providing effectiveness data for feeding interventions in populations of any age with CP. We included studies focused on nonsurgical and surgical interventions for feeding and nutrition difficulties. Nonsurgical interventions included positioning, oral appliances, oral stimulation, sensorimotor facilitation, and caregiver training. Surgical interventions included gastrostomy or jejunostomy tubes and fundoplication. We assessed both intermediate/surrogate and patient-centered/health outcomes. **RESULTS:** Fifteen articles (comprising 13 unique studies) met our inclusion criteria. One good quality systematic review on behavioral interventions for feeding issues in individuals with cerebral palsy was published in 2011 and is updated with one additional study on caregiver education in this review. The existing review included 21 studies with conflicting results related to the effects of sensorimotor interventions on short-term improvements in feeding. Eleven studies (nine case series) of surgical interventions met our inclusion criteria. These studies included 309 children. In all nine studies of gastrostomy (with or without fundoplication), gastrostomy-fed children gained weight. Baseline weight z-scores ranged from -3.56 to -0.39; followup z-scores ranged from -2.63 to -0.33, relative to typically developing populations. Two studies assessed fundoplication for reflux: in one RCT both Nissen fundoplication and vertical gastric plication reduced reflux (reduction in symptoms of 57% and 43%, respectively), while in one case series, reflux recurred within 12-months postfundoplication in 30 percent of children. The highest rates of reported

harms in any study were minor site infection (59%), formation of granulation tissue (42%), gastric leakage, recurrent reflux (30%), and aspiration and pneumonia (29%). Even though the reported death rates ranged from 7 percent to 29 percent, the underlying cause of death was most likely not due to the surgical treatment. **CONCLUSIONS:** Evidence for behavioral interventions for feeding disorders in CP consists of mostly small, short-term, pre-post studies, with strength of evidence ranging from insufficient to moderate. Some studies suggest that interventions such as oral appliances may enhance oral sensorimotor skills, but there is a clear need for rigorous, comparative studies. Evidence for surgical interventions is insufficient to low. All studies to date demonstrate significant weight gain with gastrostomy. Results for other growth measures are mixed, and substantial numbers of children remained underweight, although given a lack of appropriate reference standards for the CP population, these results should be interpreted cautiously. Longer term, comprehensive case series are needed, as are prospective cohort studies. More research is needed to understand potential harms in the context of benefits and potential risks of not treating.

[PMID: 23596639](#) [PubMed] [Free full text](#)

15. Spinal Cord. 2013 Apr 16. doi: 10.1038/sc.2013.26. [Epub ahead of print]

Supine and upright urodynamic evaluation of incontinent ileovesicostomy in wheelchair-bound adults with neurogenic bladder.

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Study design: Prospective. Objectives: To evaluate detrusor leak point pressure (DLPP) of the incontinent ileovesicostomy in the supine and upright position. Setting: California, USA. Methods: Urodynamic assessment of patients, 6-36 months after ileovesicostomy, was performed in the supine position and then immediately repeated in the upright position in the patient's wheelchair. Results: Upright and supine urodynamic evaluation was performed following the Good Urodynamic Practice Guidelines. Ten patients (seven male and three female) were evaluated. Etiology of neurogenic bladder (NGB) included seven patients with spinal cord injury and one patient each with multiple sclerosis, myelomeningocele and cerebral palsy. Mean DLLP in the supine position was 8.6 cm H₂O (range 2-20); mean DLLP in the sitting position was 11.6 cm H₂O (range 5-25). Mean change in DLPP from supine to sitting was 3.1 cm H₂O (range 1-12). The difference in DLPP between supine and sitting is statistically significant ($P=0.0429$); however, this does not appear to be a clinically significant difference. Conclusion: Ileovesicostomy is a safe option for management of the NGB in a selected patient population. A small and clinically insignificant or no change in DLPP was documented in all ten patients. We demonstrated that DLPP remains low within an ileovesicostomy while in the sitting position.

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16. Disabil Rehabil. 2013 Apr 18. [Epub ahead of print]

Pain, pain anxiety and emotional and behavioural problems in children with cerebral palsy.

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Purpose: Pain is commonly experienced in those with cerebral palsy (CP), and previous research suggests an increase in behavioural and emotional problems in children experiencing pain and pain anxiety. Therefore, it was hypothesised that pain intensity and pain anxiety would predict behavioural and emotional problems in children with CP. Method: Parents or guardians of 61 children (38 boys, 23 girls) with CP, aged 5-15 years completed an online questionnaire on pain intensity, pain anxiety and behavioural and emotional problems. Correlation and a multiple linear regression analyses were conducted to examine whether pain intensity and/or pain anxiety predicts behavioural and emotional problems. Results: A total of 59% of participants reported that their children with CP currently experiences pain. Multiple regression analyses revealed that pain intensity ($p=0.038$) and pain anxiety ($p<0.001$) both made a significant and independent contributions in predicting anxiety in children, however, pain

anxiety was the only predictor that made a significant and independent contribution to the depression ($p=0.001$) and the behavioural and emotional problems measure ($p=0.004$). Conclusions: Whilst pain intensity appears to be associated with behavioural and emotional problems in children, pain anxiety may be more strongly associated still. Implications for Rehabilitation Pain intensity and pain anxiety may have strong associations with behavioural and emotional problems in children with Cerebral Palsy (CP) Pain anxiety may be a stronger predictor of behavioural and emotional problems than the actual pain experienced in children with CP Clinicians may need to consider how children's perception of their pain affects their behavioural and emotional outcomes, as these may significantly affect the outcome of the rehabilitation.

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17. Child Care Health Dev. 2013 Apr 17. doi: 10.1111/cch.12062. [Epub ahead of print]

Family ecology of young children with cerebral palsy.

Laforme Fiss A, Chiarello LA, Bartlett D, Palisano RJ, Jeffries L, Almasri N, Chang HJ.

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BACKGROUND: Family ecology in early childhood may influence children's activity and participation in daily life. The aim of this study was to describe family functioning, family expectations of their children, family support to their children, and supports for families of young children with cerebral palsy (CP) based on children's gross motor function level. **METHODS:** Participants were 398 children with CP (mean age = 44.9 months) and their parents residing in the USA and Canada. Parents completed four measures of family ecology, the Family Environment Scale (FES), Family Expectations of Child (FEC), Family Support to Child (FSC) and Family Support Scale (FSS). **RESULTS:** The median scores on the FES indicated average to high family functioning and the median score on the FSS indicated that families had helpful family supports. On average, parents reported high expectations of their children on the FEC and strong support to their children on the FSC. On the FES, higher levels of achievement orientation were reported by parents of children in Gross Motor Function Classification System (GMFCS) level II than parents of children in level I, and higher levels of control were reported by parents of children in level I than parents of children in level IV. On the FEC, parents of children with limited gross motor function (level V) reported lower expectations than parents of children at all other levels. **CONCLUSIONS:** Family ecology, including family strengths, expectations, interests, supports and resources, should be discussed when providing interventions and supports for young children with CP and their families.

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Prevention and Cure

18. Am J Obstet Gynecol. 2013 Feb;208(2):161-2. doi: 10.1016/j.ajog.2012.11.024. Epub 2012 Nov 19.

The use of aspirin during pregnancy.

Demers S, Roberge S, Bujold E.

Comment in

Reply: Crystal P. Tyler, for the ELGAN Study Authors. [Am J Obstet Gynecol. 2013]

Comment on

Brain damage in preterm newborns and maternal medication: the ELGAN Study. [Am J Obstet Gynecol. 2012]

[PMID: 23174288](#) [PubMed - indexed for MEDLINE]

19. Am J Obstet Gynecol. 2013 Feb;208(2):160-1. doi: 10.1016/j.ajog.2012.11.022. Epub 2012 Nov 19.

Brain damage and maternal medication.

O'Callaghan ME, MacLennan AH.

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Brain damage in preterm newborns and maternal medication: the ELGAN Study. [Am J Obstet Gynecol. 2012]

[PMID: 23174287](#) [PubMed - indexed for MEDLINE]

20. Am J Reprod Immunol. 2013 Apr 17. doi: 10.1111/aji.12118. [Epub ahead of print]

Magnesium Sulfate Increases Intracellular Magnesium Reducing Inflammatory Cytokine Release in Neonates.

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PROBLEM: Magnesium sulfate (MgSO₄) exposure reduces the risk of cerebral palsy. As neonatal inflammatory cytokine levels strongly correlate with neurologic outcome, we hypothesize that MgSO₄ decreases inflammatory cytokine production. **METHOD OF STUDY:** We assessed the effect of MgSO₄ on cellular magnesium levels, cytokine production, and release within THP-1 and cord blood mononuclear cells. **RESULTS:** MgSO₄ exposure increased intracellular magnesium levels, reducing the frequency of THP-1 cells producing IL-1 β , IL-8, and TNF- α following LPS stimulation. Significant reductions in the frequency of neonatal monocytes producing TNF- α (48%) and IL-6 (37%) were seen following LPS stimulation, and MgSO₄ also significantly decreased the frequency of monocytes producing TNF- α (35%) under basal conditions. Decreased cytokine production was confirmed via ELISA, demonstrating a sustained effect and dose response. Magnesium also reduced cytokine production following stimulation with TLR ligands representing obstetrical infections (group B Streptococcus and Mycoplasma) and in preterm neonatal monocytes. **CONCLUSION:** MgSO₄ increases intracellular magnesium, reducing inflammatory cytokine production and release, potentially elucidating the mechanism by which MgSO₄ prevents cerebral palsy, eclampsia, and preterm birth.

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21. Ann Neurol. 2013 Jan 29. doi: 10.1002/ana.23843. [Epub ahead of print]

Elevated temperature and 6- to 7-year outcome of neonatal encephalopathy.

Laptook AR, McDonald SA, Shankaran S, Stephens BE, Vohr BR, Guillet R, Higgins RD, Das A; Extended Hypothermia Follow-up Subcommittee of the National Institute of Child Health and Human Development Neonatal Research Network.

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OBJECTIVE: A study was undertaken to determine whether higher temperature after hypoxia-ischemia is

associated with death or intelligence quotient (IQ)<70 at 6 to 7 years among infants treated with intensive care without hypothermia. METHODS: Control infants (noncooled, n=106) of the National Institute of Child Health and Human Development Neonatal Research Network hypothermia trial had serial esophageal and skin temperatures over 72 hours. Each infant's temperature was ranked to derive an average of the upper and lower quartile, and median of each site. Temperatures were used in logistic regressions to determine adjusted associations with death or IQ<70 at 6 to 7 years. Secondary outcomes were death, IQ<70, and moderate/severe cerebral palsy (CP). IQ and motor function were assessed with Wechsler Scales for Children and Gross Motor Function Classification System. Results are odds ratio (OR; per degree Celsius increment within the quartile or median) and 95% confidence interval (CI). RESULTS: Primary outcome was available for 89 infants. At 6 to 7 years, death or IQ<70 occurred in 54 infants (37 deaths, 17 survivors with IQ<70) and moderate/severe CP in 15 infants. Death or IQ<70 was associated with the upper quartile average of esophageal (OR=7.3, 95% CI=2.0-26.3) and skin temperature (OR=3.5, 95% CI=1.2-10.4). CP was associated with the upper quartile average of esophageal (OR=12.5, 95% CI=1.02-155) and skin temperature (OR=10.3, 95% CI=1.3-80.2). INTERPRETATION: Among noncooled infants of a randomized trial, elevated temperatures during the first postnatal days are associated with increased odds of a worse outcome at 6 to 7 years. *Ann Neurol* 2013.

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22. Indian Pediatr. 2013 Mar 5. pii: S097475591200788. [Epub ahead of print]

Outcome of Very Low Birth Weight Infants with Abnormal Antenatal Doppler Flow Patterns, A Prospective Cohort Study.

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BACKGROUND: Fetal growth restriction and abnormal Doppler flow studies are commonly associated. Neonatal outcomes are not well known particularly in developing countries, where the burden of the disease is the highest. **OBJECTIVE:** To determine outcomes of preterm infants with history of absent/reversed end-diastolic umbilical artery Doppler flow (AREDF) vs. infants with forward end-diastolic flow (FEDF). **DESIGN:** Cohort study. **SETTING:** Tertiary care perinatal center in India. **PARTICIPANTS:** 103 AREDF very low birth weight (<1500 gm) (VLBW) infants and 117 FEDF VLBW infants were prospectively enrolled. **RESULTS:** At 40 weeks adjusted post-menstrual age, AREDF vs. FEDF group had a higher risk for death in the NICU (12%; vs. 1%;), respiratory distress syndrome (33%; vs. 19%;), and cystic periventricular leukomalacia (12%; vs. 1%;). At 12-18 months corrected age, AREDF vs. FEDF group had a trend towards increased risk for cerebral palsy (7%; vs. 1%;, P=0.06). After logistic regression analysis, adjusting for confounders, AREDF was independently associated only with mortality in the NICU. **CONCLUSION:** In a developing country, AREDF was an independent predictor of adverse outcomes in preterm infants.

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23. Neuroscience. 2013 Apr 15. pii: S0306-4522(13)00339-4. doi: 10.1016/j.neuroscience.2013.04.021. [Epub ahead of print]

The Effect of Maternal Infection on Cognitive Development and Hippocampus Neuronal Apoptosis, Proliferation and Differentiation in the Neonatal Rats.

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Many epidemiological reports stated a strong association between maternal infection and development of cerebral palsy, which is a major cause of cognitive impairment. The pathophysiological mechanism of intrauterine inflammation is complex. Recently, it was demonstrated that inflammation has a modulating effect on adult neurogenesis. In this study, we discovered the effect of maternal infection to hippocampal neuronal apoptosis, proliferation and differentiation, and cognitive development in the developing brains of neonatal rats. Morris water maze test was used to assess learning and memory. TUNEL assay was used to determine neuronal apoptosis, immunostaining was conducted to assess neurogenesis, and Western blot for ERK, CREB and BDNF expression in the hippocampus. Results demonstrated that maternal infection increased neuronal apoptosis and significantly impaired spatial learning and memory ability. Maternal infection significantly increased cell proliferation, accompanied by an increased expression of ERK (P3-P7), CREB (P3-P7) and BDNF (P3). On P28, there was no significant difference of cell survival and differentiation in two groups. These results suggest that variation in ERK activity and subsequent expression of its downstream targets, including CREB and BDNF might contribute, at least partially, to modulation of inflammation related cell proliferation, survival and differentiation. Maternal infection increased hippocampal neuronal apoptosis and affect cell proliferation and differentiation in neonatal rats, which may be regarded as an etiological factor in cognitive development impairment.

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24. *Pediatr Neonatol.* 2013 Jan 21. pii: S1875-9572(12)00215-X. doi: 10.1016/j.pedneo.2012.12.006. [Epub ahead of print]

Pelizaeus-Merzbacher Disease, Easily Misdiagnosed as Cerebral Palsy: A Report of a Three-generation Family.

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Pelizaeus-Merzbacher disease (PMD) is an X-linked recessive disorder affecting myelination of the central nervous system, and is caused by mutations of the proteolipid protein 1 (PLP1) gene. Clinical manifestations of PMD are variable and major features include progressive nystagmus, spasticity, tremor, ataxia, and psychomotor delay. We describe a classical PMD patient who had been misdiagnosed as cerebral palsy. He had nystagmus and psychomotor delay since infancy and tremor with ataxia developing gradually. Brain MRI revealed demyelination over white matter of the cerebral hemispheres and posterior limbs of the internal capsules. Positive family history led to subsequent mutation analysis, which identified a novel mutation (c.88G>C) in PLP1 in the proband, as well as his affected brother and maternal uncle, and asymptomatic maternal grandmother, mother and two sisters. Therefore, PMD should be considered in a cerebral palsy-like patient with or without positive family history. Mutation analysis is crucial for early diagnosis and further genetic counseling.

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25. *Pediatr Neonatol.* 2013 Feb 17. pii: S1875-9572(13)00002-8. doi: 10.1016/j.pedneo.2013.01.001. [Epub ahead of print]

Prognostic Factors of Developmental Outcome in Neonatal Seizures in Term Infants.

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BACKGROUND: The purpose of this study was to identify prognostic indicators of neurodevelopmental outcome in

term infants who experienced clinical neonatal seizure. **METHODS:** This is a retrospective, observational hospital-based study. Term infants who experienced clinical neonatal seizure between January 1999 and December 2009 were enrolled. Adverse outcomes were defined as death, cerebral palsy, global developmental delay, and/or epilepsy. The associations between adverse outcomes and 17 variables, including sex, mode of delivery, being small of gestational age, maternal illness, perinatal insults, meconium stained liquor, Apgar score at 1 and 5 minutes, seizure onset age, seizure type, etiology, electroencephalography (EEG) findings, antiepileptic drug efficacy, presence of metabolic acidosis, and cranial ultrasonographic findings, and presence of congenital heart disease were analyzed. **RESULTS:** Among the 232 enrolled infants, 125 had a normal outcome and 14 had mild functional disability (59.9%), and 55 (23.7%) survived with one or more neurodevelopmental impairments (7 with cerebral palsy, 48 with global developmental delay), and 38 (16.4%) died. Forty-seven (23.0%) of the 204 patients who survived after the first discharge had epilepsy. Ten variables were associated with adverse outcome on univariate analysis, but only four variables, i.e., including abnormal cranial ultrasonography findings, abnormal anterior cerebral artery resistance index, abnormal EEG findings, and presence of congenital heart disease were independent predictors on multivariate logistic regression analysis. **CONCLUSION:** In term infants with neonatal seizures, several risk factors related to adverse outcome were recognized. Physicians should pay more attention to these factors when handling patients with neonatal seizures.

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