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## Interventions and Management

**1. Res Dev Disabil. 2014 Jul 30;35(11):2766-2772. doi: 10.1016/j.ridd.2014.07.006. [Epub ahead of print]**

**Effects of self-control and instructor-control feedback on motor learning in individuals with cerebral palsy.**

Hemayattalab R.

In this study we investigated the effects of "self-control and instructor-control feedback" on motor learning in individuals with cerebral palsy (CP). For this reason 22 boy students with CP type I ( $12.26 \pm 3.11$  years of age) were chosen. They were put into self-control feedback, instructor-control feedback and control groups. All participants practiced dart throwing skill for 5 sessions (4 blocks of 5 trails each session). The self-control group received knowledge of results (KR) feedback for half of their trials whenever they wanted. The instructor-control group received KR feedback after half of both their good and bad trails. The control group received no feedback for any trails. The acquisition test was run immediately at the end of each practice session (the last block) and the retention and transfer tests were run 24h following the acquisition phase. Analyses of variance with repeated measures and Post hoc tests were used to analyze the data. According to the results of this study, individuals with CP have the ability of acquiring and retaining a new motor skill. Also, it was found that self-control feedback is effective than instructor-control feedback on learning of a motor task in individuals with CP as in the average population. These findings show that rules regarding feedback also apply to people afflicted with CP.

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**2. J Orthop Res. 2014 Aug 2. doi: 10.1002/jor.22698. [Epub ahead of print]**

**Hip contact force in presence of aberrant bone geometry during normal and pathological gait.**

Bosmans L1, Wesseling M, Desloovere K, Molenaers G, Scheys L, Jonkers I.

Children with cerebral palsy (CP) often present aberrant hip geometry, specifically increased femoral anteversion and neck-shaft angle. Furthermore, altered gait patterns are present within this population. We analyzed the effect of aberrant femoral geometry, as present in CP subjects, on hip contact force (HCF) during pathological and normal gait. We ran dynamic simulations of CP-specific and normal gait using two musculoskeletal models (MSMs), one reflecting normal femoral geometry and one reflecting proximal femoral deformities. The combination of aberrant bone geometry and CP-specific gait characteristics reduced HCF compared to normal gait on a CP

subject-specific MSM, but drastically changed the orientation of the HCF vector. The HCF was orientated more vertically and anteriorly than compared to HCF orientation during normal gait. Furthermore, subjects with more pronounced bony deformities encountered larger differences in resultant HCF and HCF orientation. When bone deformities were not accounted for in MSMs of pathologic gait, the HCF orientation was more similar to normal children. Thus, our results support a relation between aberrant femoral geometry and joint loading during pathological/normal gait and confirm a compensatory effect of altered gait kinematics on joint loading.

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### 3. PLoS One. 2014 Aug 4;9(8):e103095. doi: 10.1371/journal.pone.0103095. eCollection 2014.

#### **Gait Pattern Differences between Children with Mild Scoliosis and Children with Unilateral Cerebral Palsy.**

Domagalska-Szopa M1, Szopa A2.

This study was conducted to investigate the effects of asymmetrical body posture alone, i.e., the effects seen in children with mild scoliosis, vs. the effects of body posture control impairment, i.e., those seen in children with unilateral cerebral palsy on gait patterns. Three-dimensional instrumented gait analysis (3DGA) was conducted in 45 children with hemiplegia and 51 children with mild scoliosis. All the children were able to walk without assistance devices. A set of 35 selected spatiotemporal gait and kinematics parameters were evaluated when subjects walked on a treadmill. A cluster analysis revealed 3 different gait patterns: a scoliotic gait pattern and 2 different hemiplegic gait patterns. The results showed that the discrepancy in gait patterns was not simply a lower limb kinematic deviation in the sagittal plane, as expected. Additional altered kinematics, such as pelvic misorientation in the coronal plane in both the stance and swing phases and inadequate stance phase hip ad/abduction, which resulted from postural pattern features, were distinguished between the 3 gait patterns. Our study provides evidence for a strong correlation between postural and gait patterns in children with unilateral cerebral palsy. Information on differences in gait patterns may be used to improve the guidelines for early therapy for children with hemiplegia before abnormal gait patterns are fully established. The gait pathology characteristic of scoliotic children is a potential new direction for treating scoliosis that complements the standard posture and walking control therapy exercises with the use of biofeedback.

[PMID: 25089908](#) [PubMed - in process] PMCID: PMC4121082 Free PMC Article

### 4. J Neuroeng Rehabil. 2014 Aug 5;11(1):116. [Epub ahead of print]

#### **A comparison of three accelerometry-based devices for estimating energy expenditure in adults and children with cerebral palsy.**

Ryan JM, Walsh M, Gormley J.

**BACKGROUND:** Advanced accelerometry-based devices have the potential to improve the measurement of everyday energy expenditure (EE) in people with cerebral palsy (CP). The aim of this study was to investigate the ability of two such devices (the Sensewear ProArmband and the Intelligent Device for Energy Expenditure and Activity) and the ability of a traditional accelerometer (the RT3) to estimate EE in adults and children with CP. **METHODS:** Adults ( $n = 18$ ; age  $31.9 \pm 9.5$  yr) and children ( $n = 18$ ; age  $11.4 \pm 3.2$  yr) with CP (GMFCS levels I-III) participated in this study. Oxygen uptake, measured by the Oxycon Mobile portable indirect calorimeter, was converted into EE using Weir's equation and used as the criterion measure. Participants' EE was measured simultaneously with the indirect calorimeter and three accelerometers while they rested for 10 minutes in a supine position, walked overground at a maximal effort for 6 minutes, and completed four treadmill activities for 5 minutes each at speeds of 1.0 km.h<sup>-1</sup>, 1.0 km.h<sup>-1</sup> at 5% incline, 2.0 km.h<sup>-1</sup>, and 4.0 km.h<sup>-1</sup>. **RESULTS:** In adults the mean absolute percentage error was smallest for the IDEEA, ranging from 8.4% to 24.5% for individual activities (mean 16.3%). In children the mean absolute percentage error was smallest for the SWA, ranging from 0.9% to 23.0% for individual activities mean (12.4%). Limits of agreement revealed that the RT3 provided the best agreement with the indirect calorimeter for adults and children. The upper and lower limits of agreement for adults were 3.18 kcal.min<sup>-1</sup> (95% CI = 2.66 to 3.70 kcal.min<sup>-1</sup>) and -2.47 kcal.min<sup>-1</sup> (95% CI = -1.95 to -3.00 kcal.min<sup>-1</sup>), respectively. For children, the upper and lower limits of agreement were 1.91 kcal.min<sup>-1</sup> (1.64 to 2.19 kcal.min<sup>-1</sup>) and -0.92 kcal.min<sup>-1</sup>.

1 (95% CI = -1.20 to -0.64 kcal.min<sup>-1</sup>) respectively. These limits of agreement represent -67.2% to 86.3% of mean EE for adults and -36.5% to 76.3% of mean EE for children. **CONCLUSIONS:** Although the RT3 provided the best agreement with the indirect calorimeter the RT3 could significantly overestimate or underestimate individual estimates of EE. The development of CP-specific algorithms may improve the ability of these devices to estimate EE in this population.

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##### **5. J Pediatr Rehabil Med. 2014 Jan 1;7(2):143-53. doi: 10.3233/PRM-140283.**

#### **Bone health in cerebral palsy: Who's at risk and what to do about it?**

Houlihan CM.

CP is the most prevalent childhood condition associated with low bone mass. Bone density is decreased in children with CP who sustain fragility fractures that impair function and quality of life. Predicting accurately who is at risk for fracture, preventing or reversing low bone mass and maximizing bone accrual during critical stages of growth are essential to minimizing future lifelong risks of fractures. This review article addresses the diagnosis of low bone mass, the anatomy of bone, risk factors for low bone density and for the prevention and treatment for low bone mass for children with CP.

[PMID: 25096866](#) [PubMed - in process]

##### **6. Brain Stimul. 2014 Jun 25. pii: S1935-861X(14)00183-1. doi: 10.1016/j.brs.2014.06.003. [Epub ahead of print]**

#### **Deep Brain Stimulation Evoked Potentials May Relate to Clinical Benefit in Childhood Dystonia.**

Bhanpuri NH1, Bertucco M1, Ferman D2, Young SJ1, Liker MA3, Krieger MD3, Sanger TD4.

**BACKGROUND:** Deep brain stimulation (DBS) of the globus pallidus internus (GPI) is a treatment for severe childhood-onset dystonia. A common challenge for clinicians is determining which contacts of the DBS electrode to stimulate in order to provide maximum future benefit to the patient. **OBJECTIVE:** To characterize how the cortical responses to DBS relate to stimulation parameters (i.e. electrode contacts, voltage, and pulse width) and clinical outcomes. **METHODS:** We examined 11 patients with dystonia undergoing DBS therapy (9-21 years old when implanted). We varied the active contacts, voltage, and pulse width of the stimulating electrode and analyzed the deep-brain stimulator evoked potentials (DBSEPs) measured with electroencephalogram, and assessed symptoms with the Barry-Albright dystonia scale. Statistical tests included: Repeated measures ANOVA, Mann-Whitney U test and paired t-test. **RESULTS:** DBSEPs near sensorimotor areas were larger ipsilaterally than contralaterally (P = 0.007). The rate of DBSEP amplitude increase with respect to stimulator voltage (voltage gain) and pulse width (pulse width gain) varied across subjects and stimulating contacts. Voltage gains were significantly higher among patients who showed larger improvements with DBS (P = 0.038). Additionally, a within-subject comparison of all patients showed that voltage gains were higher for contacts chosen for chronic stimulation as compared to those that were not (P = 0.007). **CONCLUSIONS:** DBSEPs may be good predictors of therapeutic response to stimulation at different electrode contacts. Furthermore, effective DBS therapy appears to modulate sensorimotor cortex. These findings may help clinicians optimize stimulator programming and may eventually lead to improved targeting during implantation.

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**7. Orthopade. 2014 Jul;43(7):649-55. doi: 10.1007/s00132-013-2219-5.**

**Unilateral spastic cerebral palsy (hemiparesis) [Article in German]**

Senst S.

**BACKGROUND:** Approximately 33 % of spastic movement disorders are due to unilateral spastic cerebral palsy which is characterized by a one-sided motor movement disorder which has a correlative in focal contralateral brain injury. The upper extremities are more severely affected so that ambulatory movement is nearly always possible. **THERAPY:** The development is substantially influenced by epilepsy and perception disturbances. Therefore, an interdisciplinary team is necessary for optimal therapy. In addition to physiotherapy and ergotherapy, orthopedic technicians, orthopedic and hand surgeons in particular are also required. The different classifications and therapy approaches are described. **CONCLUSION:** By orthopedic and hand surgical interventions flexible and structural alterations can be improved but a normalization of arm and leg functions is not possible. The prognosis in the presence of dystonia and ataxia is particularly unfavorable.

[PMID: 25100287](#) [PubMed - in process]

**8. Farm Hosp. 2014 May 1;38(3):193-201. doi: 10.7399/fh.2014.38.3.1163.**

**Cost analysis of the use of botulinum toxin type A in Spain [Article in Spanish]**

de Andrés-Nogales F1, Morell A2, Aracil J3, Torres C4, Oyagüez I5, Casado MA6.

**OBJECTIVE:** To estimate treatment costs of blepharospasm, cervical dystonia(CD), upper limb spasticity (ULS) and spasticity in children with cerebral palsy (SCCP) with botulinum neurotoxin type A (BoNT-A) in Spain. **METHOD:** Annual BoNT-A treatment costs were calculated (2013 ex-factory price (□) applying RDL 8/2010 and RDL 9/2011 deductions), based on initial dose (id), average dose (ad) and maximum dose (md) according to Summary of Product Characteristics of Botox® (100U/50U), Dysport®(500U) and Xeomin® (100U) and considering the use of complete vials.In addition, annual treatment costs were calculated considering the use of vials in more than one patient and also patient population annual treatment costs based on diseases' prevalence. **RESULTS:** Annual BoNT-A treatment costs per patient were estimated at between 265 and 2,120 with savings from 10% to 55% according to the selected BoNT-A. CD and ULS treatment provided the greatest cost per patient. Botox® provided greater savings in ULS (id/ad), CD(id), and in blepharospasm and SCCP (id/ad/md). Dysport® treatment was less costly in CD (md) and ULS (md), while Xeomin® was in CD(ad). Based on the estimated treated population in Spain, the annual treatment costs ranged from 368,392 to 13,958,836 depending on indication, dose and BoNT-A considered. **CONCLUSIONS:** The appropriate BoNT-A choice would lead to considerable savings for the National Health System. Botox® would generate lower costs per patient than other BoNT-A products in 9 out of 12 scenarios considered.

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**9. J Clin Pediatr Dent. 2014 Apr 1;38(3):235-239.**

**Assessment of Salivary Total Antioxidant Levels and Oral Health Status in Children with Cerebral Palsy.**

Subramaniam P, Mohan Das L, Girish Babu K.

Oxidative stress plays a pivotal role in the pathogenesis of neurological disorders. Saliva may constitute a first line of defence, against free radical-modified oxidative stress. The objective of the present study was to evaluate Total Antioxidant Capacity(TAC), levels of Nitric Oxide(NO), and Sialic Acid (SA) in saliva of cerebral palsied children. **Study design:** Thirty four non-institutionalized children in the age group of 7-12 years having cerebral palsy formed the study group. The control group consisted of thirty three normal, healthy children. The W.H.O. criteria was used for diagnosis and recording of dental caries. Oral hygiene status was assessed using the Simplified Oral Hygiene Index OHI-S. Estimation of Total Antioxidant Capacity, levels of Nitric Oxide and Sialic Acid in saliva was done. Data obtained was subjected to statistical analysis. **Results:** Children with CP had higher deft scores than that of

normal children. Oral hygiene of children with CP was significantly poorer than that of normal children. Total Antioxidant Capacity of saliva was significantly higher in normal children than cerebral palsied children. Levels of Sialic Acid in saliva were significantly higher in cerebral palsy children. Conclusions: In children with CP, TAC of saliva showed an inverse relation with dental caries.

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**10. Sleep Med. 2014 May 23. pii: S1389-9457(14)00208-1. doi: 10.1016/j.sleep.2014.05.008. [Epub ahead of print]**

#### **Sleep disturbances in preschool age children with cerebral palsy: a questionnaire study.**

Romeo DM1, Brogna C1, Musto E1, Baranello G2, Pagliano E2, Casalino T2, Ricci D1, Mallardi M1, Sivo S1, Cota F3, Battaglia D1, Bruni O4, Mercuri E5.

**OBJECTIVES:** The study aimed to analyze (i) the prevalence of sleep disorders in pre-school children with cerebral palsy (CP) using the Sleep Disturbance Scale for Children (SDSC), (ii) the possible association with motor, cognitive and behavioral problems, and (iii) the possible differences with typically developing children matched for age and gender. **METHODS:** One-hundred children with CP (age range: 3-5 years, mean: 3.8 years) were assessed using the SDSC, the Gross Motor Function Classification System (GMFCS), the Wechsler Preschool and Primary Scale of Intelligence, and the Child Behaviour Check List (CBCL) to assess sleep, motor, cognitive, and behavioral problems, respectively. Further 100 healthy children matched for age and sex were assessed using the SDSC. **RESULTS:** An abnormal total sleep score was found in 13% of children with CP while 35% had an abnormal score on at least one SDSC factor. SDSC total score was significantly associated with pathological internalizing scores on CBCL and active epilepsy on multivariate analysis. CP group reported higher significant median scores on SDSC total, parasomnias, and difficulty in initiating and maintaining sleep factors. **CONCLUSIONS:** In pre-school children sleep disorders are more common in children with CP than in healthy control group and are often associated with epilepsy and behavioral problems.

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**11. Disabil Health J. 2014 Jun 30. pii: S1936-6574(14)00086-7. doi: 10.1016/j.dhjo.2014.06.003. [Epub ahead of print]**

#### **Feelings of loss in parents of children with Infantile Cerebral Palsy.**

Fernández-Alcántara M1, García-Caro MP2, Laynez-Rubio C3, Pérez-Marfil MN4, Martí-García C2, Benítez-Feliponi A3, Berrocal-Castellano M5, Cruz-Quintana F4.

**BACKGROUND:** Raising a child diagnosed with Infantile Cerebral Palsy is a challenge for families and causes many changes in their lifestyle. When the diagnosis is unexpected, feelings related to loss and hard-to-manage emotions such as uncertainty and bewilderment can arise. **OBJECTIVE:** To identify how feelings of loss are structured in fathers and mothers of children diagnosed with Infantile Cerebral Palsy. **METHODS:** A qualitative design with based on a grounded theory approach was used. Twenty-four participants were selected to participate in the research from San Cecilio Clinical Hospital in the city of Granada (Spain). The sampling procedure was purposive based on inclusion and exclusion criteria and ended when data saturation was acquired. The participants were interviewed according to a script developed ad hoc. Data were collected during 2012. The interviews were analyzed with Atlas.ti 6.2 software, using the sequence suggested by Straus and Corbin including open, axial and selective codification. **RESULTS:** The analysis led to the identification of the main category, "Experiences of loss." The codes contributing to explain these experiences were "Shock," "Hope," "Traumatic Experience," "Feelings related to loss," "Ideal Child" and "Acceptance of the Child." **CONCLUSIONS:** These parents experience feelings of loss of the ideal child, which are more complex in the first stage of the diagnosis and when the severity of the cerebral palsy is greater. Emotional intervention on the part of health care providers is needed to aid parents in facing the various obstacles encountered throughout their child's up-bringing.

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## Prevention and Cure

**12. Obstet Gynecol Surv. 2014 Jun;69(6):359-368. doi: 10.1097/OGX.000000000000076.**

### **A Moving Line in the Sand: A Review of Obstetric Management Surrounding Periviability.**

Arora KS1, Miller ES2.

Perivable birth poses numerous clinical and ethical challenges for the practicing clinician. We review the data surrounding the administration of corticosteroids for fetal lung maturity, antibiotics in the case of preterm premature rupture of membranes, magnesium sulfate for cerebral palsy prophylaxis, fetal monitoring, and cesarean delivery. The ethical complexities of patient counseling are also reviewed with a recommendation toward shared decision making between patient and physician.

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**13. Neuropediatrics. 2014 Aug 6. [Epub ahead of print]**

### **Unilateral Cerebellar and Brain Stem Hypoplasia in a Child with a Postnatal Diagnosis of Dissecting Aneurysm in Basilar Artery.**

Akkas-Yazici S1, Benbir G1, Kocer N2, Yalcinkaya C1.

Cerebellum is highly vulnerable in the prenatal period. Increasing experience with fetal imaging studies has demonstrated that unilateral cerebellar hypoplasia (UCH) is mainly prenatally acquired, representing disruption rather than a true malformation. Here, we report the case of a 17-month-old boy presented with a sudden onset of abnormal eye movements, who was diagnosed during routine fetal screening with UCH and brain stem hypoplasia and suffered from cerebral palsy; however, no posterior arterial system pathology was detected on cranial magnetic resonance images at that time. Following this acute event, diagnostic neuroradiological interventions revealed a dissecting aneurysm with a saccular component in midbasilar arterial segment and hypoplastic left posterior cerebral artery, which may support the ischemic disruptive mechanism in the development of prenatally detected UCH in this child. The pathogenetic mechanisms for cerebellar disruption are certainly multifactorial in origin, although ischemic arterial etiologies were often undervalued.

Georg Thieme Verlag KG Stuttgart · New York.

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**14. Eur Radiol. 2014 Aug 6. [Epub ahead of print]**

### **Arterial spin-labelling perfusion MRI and outcome in neonates with hypoxic-ischemic encephalopathy.**

De Vis JB1, Hendrikse J, Petersen ET, de Vries LS, van Bel F, Alderliesten T, Negro S, Groenendaal F, Benders MJ.

**PURPOSE:** Hyperperfusion may be related to outcome in neonates with hypoxic-ischemic encephalopathy (HIE). The purpose of this study was to evaluate whether arterial spin labelling (ASL) perfusion is associated with outcome in neonates with HIE and to compare the predictive value of ASL MRI to known MRI predictive markers.

**METHODS:** Twenty-eight neonates diagnosed with HIE and assessed with MR imaging (conventional MRI, diffusion-weighted MRI, MR spectroscopy [MRS], and ASL MRI) were included. Perfusion in the basal ganglia and thalami was measured. Outcome at 9 or 18 months of age was scored as either adverse (death or cerebral palsy)

or favourable. RESULTS: The median (range) perfusion in the basal ganglia and thalami (BGT) was 63 (28-108) ml/100 g/min in the neonates with adverse outcome and 28 (12-51) ml/100 g/min in the infants with favourable outcome ( $p < 0.01$ ). The area-under-the-curve was 0.92 for ASL MRI, 0.97 for MRI score, 0.96 for Lac/NAA and 0.92 for ADC in the BGT. The combination of Lac/NAA and ASL MRI results was the best predictor of outcome ( $r^2 = 0.86$ ,  $p < 0.001$ ). CONCLUSION: Higher ASL perfusion values in neonates with HIE are associated with a worse neurodevelopmental outcome. A combination of the MRS and ASL MRI information is the best predictor of outcome. KEY POINTS: • Arterial spin labelling MRI can predict outcome in neonates with hypoxic-ischemic encephalopathy • Basal ganglia and thalami perfusion is higher in neonates with adverse outcome • Arterial spin labelling complements known MRI parameters in the prediction of outcome • The combined information of ASL and MRS measurements is the best predictor of outcome.

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**15. Nurs Stand. 2014 Aug 6;28(49):17. doi: 10.7748/ns.28.49.17.s24.**

**Familial risk of cerebral palsy confirmed but absolute risk is reassuringly low.**

[No authors listed]

Babies born into families in which someone has cerebral palsy are at increased risk of having the condition, confirms the first study to investigate familial risk over a broad range of relationships including cousins.

[PMID: 25095933](#) [PubMed - in process]

**16. Pediatrics. 2014 Aug 4. pii: peds.2014-0987. [Epub ahead of print]**

**Incidence, Etiology, and Outcomes of Hazardous Hyperbilirubinemia in Newborns.**

Kuzniewicz MW1, Wickremasinghe AC2, Wu YW3, McCulloch CE4, Walsh EM5, Wi S5, Newman TB6.

BACKGROUND AND OBJECTIVES: Total serum bilirubin (TSB) levels  $\geq 30$  mg/dL are rare but potentially hazardous. A better understanding of their incidence, causes, and outcomes could help inform preventive efforts. METHODS: We identified infants born  $\geq 35$  weeks' gestational age from 1995-2011 in Kaiser Permanente Northern California ( $n = 525\,409$ ) and examined the medical records of infants with a TSB  $\geq 30$  mg/dL to determine etiology and the occurrence of acute bilirubin encephalopathy. We reviewed inpatient and outpatient encounters through 2013 for evidence of sensorineural hearing loss (SNHL) or cerebral palsy (CP). RESULTS: We identified 47 infants with TSB  $\geq 30$  mg/dL (8.6 per 100 000 births). In 44 infants (94%), the hyperbilirubinemia occurred after the initial birth hospitalization. The etiology was not identified in 33 (70%). Glucose-6-phosphate dehydrogenase (G6PD) activity was measured in only 25 (53%) of whom 10 (40%) were deficient. Four children had acute bilirubin encephalopathy of whom 2 developed both CP and SNHL, and 1 developed isolated SNHL. These 3 infants all had G6PD deficiency and TSB  $> 40$  mg/dL. One additional 35-week infant with TSB 38.2 mg/dL had SNHL. CONCLUSIONS: Hazardous ( $\geq 30$  mg/dL) hyperbilirubinemia is a rare event. No etiology could be identified from the clinical record in most cases. G6PD deficiency was the leading cause of hazardous hyperbilirubinemia when an etiology was identified, but many were not tested. Chronic, bilirubin-induced neurotoxicity was uncommon and occurred only in the setting of additional risk factors and TSB values well over ( $> 15$  mg/dL) the American Academy of Pediatrics exchange transfusion thresholds.

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17. *Lakartidningen*. 2014 Aug 4;111. pii: CU6A.

**Autismspektrumtillstånd vid svår CP upptäcks ofta sent - Retrospektiv genomgång av 10 års journaler  
[Article in Swedish]**

Dahl M1, Bergsten C2, Hammarberg A2, Sandström M2, Strinnholm M2.

The aim of the present study was to describe clinical findings in a study of children with severe cerebral palsy (CP) and a newly rendered diagnosis of autism spectrum disorders (ASD). 64 children with CP and severe motor dysfunction were admitted to Folke Bernadotte regional habilitation for investigation of their communication. Upon investigation ten of those children received a new diagnosis of ASD. Despite typical early signs and symptoms of ASD, most of those children were not diagnosed until school age. The children with ASD had significantly more early problems with feeding, sleeping and irritability compared with the children without ASD. In children with severe CP, problems with social interaction, verbal and nonverbal communication may be overlooked or regarded as a part of the disability, so a diagnosis of ASD may go unnoticed. Early diagnosis of ASD in children with severe CP is extremely important for providing those children with optimal opportunities to develop.

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