

Monday 24 August 2015

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## Interventions and Management

1. *BMC Neurol.* 2015 Aug 19;15:143. doi: 10.1186/s12883-015-0404-3.

### **Effects of botulinum toxin A and/or bimanual task-oriented therapy on upper extremity activities in unilateral Cerebral Palsy: a clinical trial.**

Speth L, Janssen-Potten Y, Rameckers E, Defesche A, Winkens B, Becher J, Smeets R, Vles H.

**BACKGROUND:** This study reports on the effects of botulinum toxin A (BoNT-A) injections in the upper extremity (UE) in children with unilateral Cerebral Palsy (uCP) combined with bimanual task-oriented therapy (BITT) or either treatment modality performed separately. Bimanual activities were measured with the Assisting Hand Assessment (AHA), the ABILHand-Kids questionnaire (AK), the Observational Skills Assessment Score (OSAS). Goal achievement was measured with Goal Attainment Scaling (GAS), using blind video assessment, and the Canadian Occupational Performance Measure (COPM). **METHODS:** Thirty-five children, mean age 7.14 years (SD 2.63), 11 Manual Ability Classification Score (MACS) I, 15 MACS II and 9 MACS III, participated. The trial started with four study groups: BoNT-A-only (n = 5), BITT-only (n = 11), BoNT-A + BITT (n = 13), and control (n = 6). Twenty-two children were randomised, 13 children received their parents' preferred treatment: BoNT-A + BITT or BITT-only. Three comparisons were analysed: BITT (BoNT-A + BITT and BITT-only; n = 24) versus no BITT (BoNT-A-only and control; n = 11), BoNT-A (BoNT-A-only and BoNT-A + BITT; n = 18) versus no BoNT-A (BITT-only and control; n = 17), and the additional effect of BoNT-A (BoNT-A + BITT versus BITT-only). Follow-up time: 24 weeks. **RESULTS:** No significant differences between the groups were found on the AHA. The amount of use of both hands on the OSAS was significantly better in the BoNT-A group in the beading and sandwich-making task. The BoNT-A group also showed significant improvement in the quality scores of the OSAS: the wrist position during grasping and holding, especially in the younger children. The BITT group improved significantly on the AK and significantly more on the performance and satisfaction scores of the COPM at 12 and 24 weeks regarding several goals. BoNT-A showed a significant negative effect at 12 and 24 weeks in the most important goal. BITT, more than BoNT-A + BITT, showed positive effects on the GAS score at 12 (significant), 18 and 24 weeks. **CONCLUSIONS:** BoNT-A has a positive effect on quality of movement and amount of use of the affected UE during the 3 months' working time. BoNT-A has no additional effect on bimanual performance and goal achievement. BITT has a positive effect on goal achievement and bimanual performance, even up to 6 weeks after therapy had stopped. **TRIAL REGISTRATION:** Current Controlled Trials ISRCTN69541857.

[PMID: 26286662](#)

## 2. Clin Orthop Relat Res. 2015 Aug 20. [Epub ahead of print]

### Determinants of Hip Displacement in Children With Cerebral Palsy.

Chang CH, Wang YC, Ho PC, Hwang AW, Kao HK, Lee WC, Yang WE, Kuo KN.

**BACKGROUND:** Coxa valga and femoral anteversion often are seen in patients with spastic hip displacement and osteotomy is recommended. However, the relationship between femoral deformities and hip displacement has not been clearly defined and other factors, such as joint motion and posture, should be considered before recommending treatment. **QUESTIONS:** For children with cerebral palsy with Gross Motor Function Classification System Level IV or V, we questioned (1) whether hip abduction range correlates with hip displacement, (2) what the relationships are between proximal femoral deformities and hip displacement, and (3) whether the patient with a windblown posture has greater degrees of femoral anteversion? **METHODS:** We retrospectively studied 31 consecutive children with cerebral palsy with Level IV or V gross motor function who underwent three-dimensional CT for preoperative assessment of hip displacement between January 2010 and December 2013. Among the children, 23 had a windblown posture and eight had symmetric hip motion. Femoral anteversion and true neck-shaft angle were measured from the three-dimensional CT images. Migration percentage was the dependent variable we chose to study in relation to femoral anteversion, neck-shaft angle, maximal hip abduction, and hip flexion contracture, using correlations and multiple linear regressions. Using ANOVA and Scheffé's post hoc tests, we analyzed and compared the data of 23 abducted hips and 23 adducted hips in the 23 children with windblown posture and in 16 displaced hips in the eight children with symmetric hip abduction. **RESULTS:** Greater migration percentage was associated with less hip abduction range ( $r = -0.86$ ;  $p < 0.001$ ). Femoral anteversion had a weak correlation ( $r = 0.28$ ;  $p < 0.05$ ) to migration percentage, and the association became insignificant after considering hip abduction motion. Adducted windblown hips had greater femoral anteversion than the symmetric displaced hips and abducted windblown hips ( $46^\circ$  vs  $36^\circ$  and  $38^\circ$ , respectively;  $p < 0.05$ ). **CONCLUSIONS:** Our study results did not support a relationship between femoral deformities and hip displacement after considering gross motor function and hip abduction motion. Greater femoral anteversion was noted in the adducted hips of patients with windblown posture, and derotation osteotomy is especially recommended. **LEVEL OF EVIDENCE:** Level III, diagnostic study.

[PMID: 26290346](#)

## 3. Res Dev Disabil. 2015 Aug 13;45-46:253-260. doi: 10.1016/j.ridd.2015.07.021. [Epub ahead of print]

### The role of exaggerated patellar tendon reflex in knee joint position sense in patients with cerebral palsy.

Manikowska F, Chen BP, Józwiak M, Lebedowska MK.

The aim of this pilot study was to determine if exaggerated patellar tendon jerk affects knee joint position sense (JPS) in cerebral palsy (CP) patients, by comparing JPS of the knee between participants with normal and exaggerated reflexes. The thresholds for reflex classification were based upon the data from able-bodied volunteers. JPS was measured as the ability of a subject (with eyes closed) to replicate a knee joint position demonstrated by an examiner. Tendon jerk was measured as the moment of force in response to patellar tendon taps. Data was collected from 27 limbs of CP patients (N=14) and 36 limbs of able-bodied volunteers (N=18). JPS was less accurate ( $p=0.014$ ) in limbs with non-exaggerated reflexes ( $50.28 \pm 43.63\%$ ) than in control limbs ( $11.84 \pm 10.85\%$ ). There was no significant difference ( $p=0.08$ ) in JPS accuracy between limbs with exaggerated reflexes ( $18.66 \pm 15.50\%$ ) and control limbs. Our data suggests that one component of sensorimotor impairment, JPS, is not as commonly affected in CP patients as previously reported. JPS of the knee is reduced in limbs with non-exaggerated reflexes; however in limbs with exaggerated reflexes which is seen in the majority of CP patients, JPS is not affected.

[PMID: 26280690](#)

#### 4. Disabil Rehabil. 2015 Aug 18:1-4. [Epub ahead of print]

##### **Balance improvement after physical therapy training using specially developed serious games for cerebral palsy children: preliminary results.**

Bonnechère B, Omelina L, Jansen B, Van Sint Jan S.

**PURPOSE:** Cerebral palsy (CP) leads to various clinical signs mainly induced by muscle spasticity and muscle weakness. Among these ones impaired balance and posture are very common. Traditional physical therapy exercise programs are focusing on this aspect, but it is difficult to motivate patients to regularly perform these exercises, especially at home without therapist supervision. Specially developed serious games (SG) could therefore be an interesting option to motivate children to perform specific exercise for balance improvement. **METHOD:** Ten CP children participated in this study. Patients received four sessions of SG included into conventional therapy (1 session of 30 min a week during 4 weeks). Trunk control and balance were assessed using Trunk Control Motor Scale (TCMS) before and after interventions. **RESULTS:** Children presented a significant improvement in TCMS global score after interventions [37.6 (8.7) and 39.6 (9.5) before and after interventions, respectively,  $p = 0.04$ ]. **CONCLUSION:** SG could therefore be an interesting option to integrate in the conventional treatment of CP children. Implication for Rehabilitation Cerebral palsy (CP) leads to balance issues. Rehabilitation exercises are not performed (enough) at home. Serious games (SG) could increase patients' motivation. SG increase balance control of CP children.

[PMID: 26289370](#)

#### 5. Eur Spine J. 2015 Aug 20. [Epub ahead of print]

##### **Combined selective dorsal rhizotomy and scoliosis correction procedure in patients with cerebral palsy.**

Muquit S, Ammar A, Nasto L, Moussa AA, Mehdian H, Vloeberghs MH.

Intrathecal baclofen (ITB) therapy for spasticity has been suggested to accelerate the development of scoliosis. We present the case of a 17-year-old female patient with cerebral palsy who had ITB therapy from the age of 11 years. During this period, she developed a severe scoliosis measuring  $86^\circ$  from T11 to L4, with pain due to costo-pelvic impingement. Her baclofen pump had reached its end of life and required replacement if ITB therapy was to continue. This coincided with plans for scoliosis corrective surgery. **METHODS:** We performed scoliosis correction along with removal of baclofen pump and selective dorsal rhizotomy (SDR), as a single combined procedure. SDR was performed instead of ITB pump replacement for management of spasticity. **RESULTS:** Following surgery, scoliosis improved to  $24^\circ$ . At 6 month follow-up, there was significant improvement in spasticity and quality of life. **CONCLUSIONS:** This report illustrates the feasibility of a combined procedure to correct scoliosis and manage spasticity with SDR. We present the case details, our management and review of the published literature regarding the factors influencing treatment of scoliosis and spasticity.

[PMID: 26289633](#)

#### 6. Res Dev Disabil. 2015 Aug 18;45-46:316-328. doi: 10.1016/j.ridd.2015.08.002. [Epub ahead of print]

##### **The clinimetric properties of aerobic and anaerobic fitness measures in adults with cerebral palsy: A systematic review of the literature.**

Lennon N, Thorpe D, Balemans AC, Fragala-Pinkham M, O'Neil M, Bjornson K, Boyd R, Dallmeijer AJ.

**OBJECTIVE:** To analyze the clinimetric properties of maximal aerobic and anaerobic fitness measurement protocols in adults with cerebral palsy (CP). **DATA SOURCES:** A systematic search through March 2015 of databases PubMed, Embase, SPORTDiscus and PsycINFO was performed with medical subject heading terms for 'cerebral palsy' combined with search terms adults or adolescents and multiple text words for fitness and exercise tests that yielded 864 articles. **STUDY SELECTION:** Abstracts were screened by two reviewers to identify use of maximal fitness measurements in adolescents (14-18yrs) or adults (>18yrs) with CP of all abilities. Ninety-four

articles were reviewed. No studies of adolescent (14-18yrs) qualified. Eight articles reported clinimetric properties for adults with CP who walk or propel a wheelchair independently. Five articles reported on aerobic capacity, one reported on anaerobic capacity and two reported on both. DATA EXTRACTION: Methodological quality of the studies was rated using portions of the COSMIN (CONsensus-based Standards for the selection of health status Measurement INSTRuments) checklist. Quality of the measurement protocols was evaluated based on statistical strength of the clinimetrics. Synthesis of the overall evidence was based on the Cochrane review group guidelines which combine methodological quality and statistical strength. DATA SYNTHESIS: Eight articles reported on 4 aerobic and 1 anaerobic protocols. Overall synthesis revealed that for ambulatory adults with CP there is (i) moderate evidence for good reliability and good construct validity of maximal aerobic and anaerobic cycle tests, (ii) moderate evidence for good criterion validity of sub-maximal aerobic cycle tests, and (iii) strong evidence for poor criterion validity of the six-minute walk test as a maximal aerobic test. And for adults who propel a wheelchair there is limited evidence of good reliability for maximal aerobic wheelchair ergometer tests. CONCLUSIONS: Limited quality research exists on the clinimetric properties of aerobic and anaerobic capacity measures for adults with CP who have independent mobility. Quality aerobic and anaerobic measures for adults with more severe mobility impairments are absent.

[PMID: 26296079](#)

### **7. Stud Health Technol Inform. 2015;217:923-8.**

#### **On the Use of Dance as a Rehabilitation Approach for Children with Cerebral Palsy: A Single Case Study.**

Morán Pascual P, Mortes Roselló E, Domingo Jacinto A, Belda Lois JM, Bermejo I, Medina E, Barberà Guillem R.

Cerebral Palsy (CP) is the most common motor disability in childhood. It is a group of permanent disorders that affect child development causing disorders of movement and posture and activity limitations. The impairment of psychomotor skills of children with Cerebral Palsy is attributed to a permanent alteration occurred in non-progressive brain development of the fetus or nursing infant. Some motor related symptoms can be treated using proper physical therapy. However, one of the biggest problems of the usual physical therapy is adherence to therapy. Ballet can be an alternative or a complement to physiotherapy, with the added attraction of not being part of a therapy, but a fun activity with the extra reward associated with the realization of an artistic activity. For some years the ballet is used as therapeutically valuable for both children with cerebral palsy: Intensive ballet training can generate changes in the sensorimotor cortex. Ballet is characterized by a complex process of movements that have to be in a musical rhythm (hence have to be precise), in which there is an overall coordination of the muscles. It is also a highly motivating and rewarding activity that allows many children with CP sharing the activities of their peers without special needs. Objective measurements of the Full Port de Bras movement has been chosen as an index of improvement. The results shows progressive improvements of the execution in a single case.

[PMID: 26294586](#)

### **8. J Child Neurol. 2015 Aug 19. pii: 0883073815599264. [Epub ahead of print]**

#### **Can Clinical Assessment of Locomotive Body Function Explain Gross Motor Environmental Performance in Cerebral Palsy?**

Sanz Mengibar JM, Santonja-Medina F, Sanchez-de-Munian P, Canteras-Jordana M.

Gross Motor Function Classification System has discriminative purposes but does not assess short-term therapy goals. Locomotion Stages (LS) classify postural body functions and independent activity components. Assessing the relation between Gross Motor Function Classification System level and Locomotion Stages will make us understand if clinical assessment can explain and predict motor environmental performance in cerebral palsy. A total of 462 children were assessed with both scales. High reliability and strong negative correlation (-0.908) for Gross Motor Function Classification System and Locomotion Stages at any age was found. Sensitivity was 83%, and specificity and positive predictive value were 100% within the same age range. Regression analysis showed detailed probabilities for the realization of the Gross Motor Function Classification System depending on the Locomotion Stages and the age group. Postural body function measure with Locomotion Stages is reliable,

sensitive, and specific for gross motor function and able to predict environmental performance.

[PMID: 26294341](#)

**9. Acta Orthop Belg. 2015 Jun;81(2):167-71.**

**Role of motor end plate-targeted Botulinum toxin type A injections in children with cerebral palsy.**

Van Campenhout A, Bar-On L, Desloovere K, Molenaers G.

Botulinum toxin type A (BTX) injections are frequently used in children with cerebral palsy (CP) to control spasticity. Injection variables still lead to variable outcomes of this treatment. Using instrumented spasticity assessment and muscle volume assessment the most effective location of the injection was demonstrated for gracilis and psoas muscles in children with CP. It was found that this treatment is most effective when injected in the motor endplate zones of the selected muscles. This review article presents all available research on the role of motor endplate-targeting of BTX injections in children with CP.

[PMID: 26280952](#)

**10. Arch Phys Med Rehabil. 2015 Aug 17. pii: S0003-9993(15)01065-5. doi: 10.1016/j.apmr.2015.07.024. [Epub ahead of print]**

**Gross Motor Function Measure Evolution Ratio: Use as a control for natural progression in cerebral palsy.**

Marois P, Marois M, Pouliot Laforte A, Vanasse M, Lambert J, Ballaz L.

**OBJECTIVE:** The aim was to develop a new way to interpret children Gross Motor Function Measure (GMFM) score improvement in studies conducted without control groups in children with cerebral palsy (CP). **DESIGN:** The curves established by Rosenbaum et al. (2002) were used as historical control in order to define the expected GMFM natural evolution (ENE) in children with CP. The curves describing the GMFM evolution during childhood, depending on the children Gross Motor Function Classification Scale (GMFCS) levels, have been modeled and generalized to fit the curve to particular children characteristics. **SETTING:** Research Center **PARTICIPANTS:** Not applicable **INTERVENTION:** Not applicable **MEAN OUTCOME MEASURE:** Not applicable **RESULTS:** Assuming that the GMFM score evolution followed the shape of the Rosenbaum curves, by taking into account the age and the GMFM score of children, the ENE of the GMFM score was predicted for groups of children situated between the GMFCS curves. As the ENE could be predicted for a specific group of children with CP, the efficacy of a treatment could be determined by comparing the GMFM score evolution measured before and after treatment with the ENE for the same period. A new index, namely the Gross Motor Function Measure Evolution Ratio (GMFM-ER), was defined as follow:  $GMFM-ER = \text{Measured GMFM score change} / \text{ENE}$ . **CONCLUSIONS:** For practical or ethical reasons it is almost impossible to use control groups in studies evaluating effectiveness of many therapeutic modalities. The GMFM-ER gives the opportunity to take into account the ENE of the gross motor function of children with cerebral palsy, which is essential to accurately interpret the therapy effect on the GMFM.

[PMID: 26292263](#)

**11. J Paediatr Child Health. 2015 Aug 19. doi: 10.1111/jpc.12995. [Epub ahead of print]**

**Sensitivity and specificity of General Movements Assessment for diagnostic accuracy of detecting cerebral palsy early in an Australian context.**

Morgan C, Crowle C, Goyen TA, Hardman C, Jackman M, Novak I, Badawi N.

**AIM:** The aim of this study was to calculate the sensitivity and specificity of the General Movements Assessment (GMA) for estimating diagnostic accuracy in detecting cerebral palsy (CP) in an Australian context by a newly

established NSW rater network. **METHODS:** A prospective longitudinal cross-sectional study was conducted. The GMA was blind-rated from conventional video by two independent certified raters, blinded to medical history. A third rater resolved disagreements. High-risk population screening for CP using the GMA during the fidgety period (12-20 weeks) was carried out in four neonatal intensive care units and one CP service over a 30-month period (2012-2013). Participants were 259 high-risk infants. Sensitivity and specificity values were calculated with true positives defined as a confirmed diagnosis of CP from a medical doctor. **RESULTS:** Of the 259 infants assessed, 1-year follow-up data were available for 187. Of these, n = 48 had absent fidgety (high risk for CP), n = 138 had normal fidgety (low risk for CP), and n = 1 had abnormal fidgety (high risk for a neurological disorder). Of the 48 with absent fidgety movements, 39 had received a diagnosis of CP by 18 months and another 6 had an abnormal outcome. Of the n = 138 normal fidgety cases, n = 99 cases had a normal outcome, n = 38 had an abnormal outcome but not CP, and n = 1 had CP. For detecting CP, we had a sensitivity of 98% and specificity of 94%. **CONCLUSION:** GMA was feasible in an Australian context and accurately identified CP with a sensitivity and specificity comparable with European standards and published neuroimaging data.

[PMID: 26289780](#)

**12. BMC Neurol. 2015 Aug 19;15:140. doi: 10.1186/s12883-015-0381-6.**

**Mitii™ ABI: study protocol of a randomised controlled trial of a web-based multi-modal training program for children and adolescents with an Acquired Brain Injury (ABI).**

Boyd RN, Baque E, Piovesana A, Ross S, Ziviani J, Sakzewski L, Barber L, Lloyd O, McKinlay L, Whittingham K, Smith AC, Rose S, Fiori S, Cunningham R, Ware R, Lewis M, Comans TA, Scuffham PA.

**BACKGROUND:** Acquired brain injury (ABI) refers to multiple disabilities arising from damage to the brain acquired after birth. Children with an ABI may experience physical, cognitive, social and emotional-behavioural impairments which can impact their ability to participate in activities of daily living (ADL). Recent developments in technology have led to the emergence of internet-delivered therapy programs. "Move it to improve it" (Mitii™) is a web-based multi-modal therapy that comprises upper limb (UL) and cognitive training within the context of meaningful physical activity. The proposed study aims to compare the efficacy of Mitii™ to usual care to improve ADL motor and processing skills, gross motor capacity, UL and executive functioning in a randomised waitlist controlled trial.

**METHODS/DESIGN:**

Sixty independently ambulant children (30 in each group) at least 12 months post ABI will be recruited to participate in this trial. Children will be matched in pairs at baseline and randomly allocated to receive either 20 weeks of Mitii™ training (30 min per day, six days a week, with a potential total dose of 60 h) immediately, or be waitlisted for 20 weeks. Outcomes will be assessed at baseline, immediately post-intervention and at 20 weeks post-intervention. The primary outcomes will be the Assessment of Motor and Process Skills and 30 s repetition maximum of functional strength exercises (sit-to-stand, step-ups and half kneel to stand). Measures of body structure and functions, activity, participation and quality of life will assess the efficacy of Mitii™ across all domains of the International Classification of Functioning, Disability and Health framework. A subset of children will undertake three tesla (3T) magnetic resonance imaging scans to evaluate functional neurovascular changes, structural imaging, diffusion imaging and resting state functional connectivity before and after intervention. **DISCUSSION:** Mitii™ provides an alternative approach to deliver intensive therapy for children with an ABI in the convenience of the home environment. If Mitii™ is found to be effective, it may offer an accessible and inexpensive intervention option to increase therapy dose. **TRIAL REGISTRATION:** ANZCTR12613000403730.

[PMID: 26286324](#)

**13. J Pediatr Orthop. 2015 Aug 20. [Epub ahead of print]**

**Infection as a Complication of Intrathecal Baclofen Treatment in Children With Cerebral Palsy.**

Bayhan IA, P Sees J, Nishnianidze T, Rogers KJ, Miller F.

**BACKGROUND:** Children with cerebral palsy (CP) and spasticity are often managed with intrathecal baclofen treatment (ITB). Complications of ITB include infection at the pump or catheter site and late complications as well

as revisions of the pump and catheter because of events such as battery expiration or implant malfunction. The goal of this study is to report the short-term and long-term incidence, risk factors, and treatment outcomes of ITB infections in children. **METHODS:** This was a retrospective review of 294 children with CP. The number of ITB surgeries per patient, risk of infection for primary and secondary ITB-related procedures, microorganisms responsible, and associated factors, such as concurrent orthopaedic interventions, medical comorbidities, and subsequent management of ITB-related infections, were evaluated. **RESULTS:** Infection occurred in 28/294 patients (9.5%) with a 4.9% rate per procedure. There were 14 acute (within 90 d of surgery) and 14 late infections. The infection risk per ITB procedure was 2.4%. Risk of late infection over 5-year mean follow-up was 0.95% per year. Pump removal with acute contralateral implantation was the most successful treatment of infections. Gross Motor Function Classification System level V and G-tube were the main risk factors for infection. A total of 133 concurrent orthopaedic procedures were performed during 277 ITB procedures with no increased risk of infection. **CONCLUSIONS:** ITB in children with CP has a relatively low and manageable risk of infection. It is important to always consider infection as a complication with ITB because with prompt treatment the positive impact of ITB is still possible. It is safe to perform concurrent orthopaedic procedures with ITB procedures. **LEVELS OF EVIDENCE:** Level III-therapeutic study.

[PMID: 26296219](#)

#### **14. Stud Health Technol Inform. 2015;217:886-91.**

##### **Goal setting for cerebral palsy children in context therapy: improve reliability when linking to ICF.**

Alvarelhão J, Queirós A, Sa-Couto P, Rocha NP.

The linking process of information to ICF is a common task in different strategies used in rehabilitation practise but is a time consuming process mainly due to reliability issues. This work aims to developed additional rules to those already published in order to improve reliability of the linking process to ICF. The results are encouraging and this work could help to develop information technologies tools for facilitate this process.

[PMID: 26294579](#)

#### **15. Zh Nevrol Psikhiatr Im S S Korsakova. 2015;115(4):41-48.**

##### **The results of single-event multilevel orthopedic surgeries and the early rehabilitation used in complex with botulinum toxin treatment in patients with spastic forms of cerebral palsy. [Article in Russian]**

Popkov DA, Zmanovskaia VA, Gubina EB, Leonchuk SS, Butorina MN, Pavlova OL.

**AIM:** To evaluate motor possibilities of patients with children spastic palsy (CSP) one year after single-event multilevel orthopedic low extremity surgeries in combination with early rehabilitation treatment including botulinum toxin treatment. **MATERIAL AND METHODS:** Authors studied the results of operative orthopedic treatment in 55 patients with CSP, aged from 5 to 17 years (mean 11.9±2.5 years), who underwent multilevel surgeries with early functional rehabilitation using 1.5 treatment courses with 6-8 week treatment-free periods during 9-12 months in combination with a single injection of disport in the post-operative period. We performed 74 surgeries 140 episodes of botulinum toxin treatment using average doses of Botulinum toxin 10 U per kg of body mass injected into low extremity muscles. **RESULTS:** In the post-operative period, authors recorded a significant reduction in pain syndrome, assessed with a pain intensity scale, from 8.6±1.2 to 4.3±1.1 scores ( $p<0,001$ ). An analysis of gait demonstrated an improvement of gait patterns in all patients able to move independently. An increase in motor abilities, measured with the Gillette Functional Assessment Questionnaire, by 1 level was identified in 28 (50.9%) patients, by 2 levels in 2 (3.6%) patients, no changes were observed in 25 (45.5%) patients. **CONCLUSION:** Single-event multilevel orthopedic surgeries in children with CSP reduce a number of repeated surgeries. The effective control over pain syndrome in patients with CSP using multilevel botulinum toxin treatment in the post-operative period promotes the functional rehabilitation, increases rates of loading during training sessions and the motivation of CSP patients to restore the lost activity.

[PMID: 26288287](#)

16. *Lancet Neurol.* 2015 Sep;14(9):876-7. doi: 10.1016/S1474-4422(15)00189-1.

### Fighting cerebral palsy in Africa.

Burton A.

Cerebral palsy affects children across Africa. Prevention is difficult since we know little about its aetiology in African countries, and efforts to help those affected are hampered by a lack of resources. But individuals and organisations are rising to the challenge. Adrian Burton reports

[PMID: 26293560](#)

## Prevention and Cure

17. *Am J Med Genet A.* 2015 Sep;167(9):vii-viii. doi: 10.1002/ajmg.a.37283.

### Genetic factors may underlie many cerebral palsy cases: New research implicates genetic variations, not lack of oxygen at birth, in disorder.

Levenson D

A recent study suggests genetic causes may underlie as many as 45% of cerebral palsy (CP) cases, an amount greater than most researchers have previously estimated. Nearly half of all patients with cerebral palsy, a disorder characterized by poor reflexes, may have genetic variations that contributed to development of the disease. Like autism, cerebral palsy is a varied condition with multiple causes and clinical types. It can result in varying degrees of disability and occurs in about two out of every 1,000 births. Until recently, CP had been widely assumed to be the result of oxygen deficiency at birth and subsequent brain damage. But an emerging body of research has linked the disorder to variations in at least six genes, Australian researchers write in the *American Journal of Obstetrics & Gynecology* (MacLennan et al., 2015). The researchers arrived at 45% based on studies they conducted and research done by others. Earlier this year, Australian researchers concluded that at least 14% of CP cases had a plausible genetic mutation, either inherited or de novo. Meanwhile, Israeli researchers have reported that 31% of CP cases they studied had copy number variations of clinical significance (Segel et al., 2015). As future research focuses on larger cohorts of patients with CP, the proportion caused by a genetic mutation is likely to rise, say MacLennan and colleagues. Historically, obstetrical literature has attributed a genetic cause to about 2% of CP cases (Rajab et al., 2006). However, some obstetricians and geneticists have long suspected genetic causes because of the link between CP and congenital malformations and the increased risk of CP in not only children whose parents are blood relations but also in identical twins. "The long-held belief that most or many cases of cerebral palsy are due to trauma or asphyxia around the time of birth and that earlier intervention can prevent the neuropathology is not evidence-based, has held back research into other pathways, and has fuelled unwarranted litigation that has had an untoward effect on modern maternity care and maternal outcomes," write MacLennan and colleagues.

[PMID: 26288074](#)

18. *Am J Obstet Gynecol.* 2015 Aug 14. pii: S0002-9378(15)00871-6. doi: 10.1016/j.ajog.2015.08.020. [Epub ahead of print]

### Early Onset Preeclampsia and Cerebral Palsy -A Double Hit Model?

Mor O, Stavsky M, Yitshak-Sade M, Andrea Mastrolia S, Beer-Weisel R, Rafaeli-Yehudai T, Besser L, Hamou B, Mazor M, Erez O.

**BACKGROUND:** Cerebral palsy (CP) is a late sequel of pregnancy, and the role of preeclampsia in it is debatable. **OBJECTIVE:** The aims of this study were to determine: 1) The association between preeclampsia and CP, and 2) The risk factors for the development of CP in these patients. **STUDY DESIGN:** A retrospective population-based

cohort study was designed, including 229,192 singleton pregnancies. The study population was divided into two groups 1) patients with preeclampsia (n=9,749) and 2) normotensive gestations (n=219,443). GEE multiple logistic regression models were performed to study the association between PE, small for gestational age (SGA), gestational age at delivery and the risk factors for the development of CP in neonates of women with preeclampsia. RESULTS: 1) the rate of CP was double in patients with preeclampsia than in the normotensive group (0.2% vs. 0.1%, p=0.015); 2) early onset preeclampsia and SGA were independent risk factors for subsequent development of CP (OR 8.639, 95% CI 4.269-17.480; OR 2.737, 95% CI 1.937-3.868, respectively). A second model was conducted to determine the risk factors for the development of CP in women with PE. Birth asphyxia, complications of prematurity and neonatal infectious morbidity, but not SGA or gestational age at delivery were independent risk factors for the development of CP. CONCLUSIONS: 1) In comparison to normal pregnant women, the rate of CP is double among patients with preeclampsia, especially in those with early-onset disease; 2) Early onset preeclampsia is an independent risk factor for CP; and 3) Among women with preeclampsia, the presence of neonatal infectious morbidity, birth asphyxia, and complications of prematurity are independent risk factors for the development of CP further supporting the role of multi-hit model in the pathogenesis of this syndrome.

[PMID: 26283455](#)

**19. BMC Pregnancy Childbirth. 2015 Aug 18;15:176. doi: 10.1186/s12884-015-0618-9.**

**Barriers and enablers to implementing antenatal magnesium sulphate for fetal neuroprotection guidelines: a study using the theoretical domains framework.**

Bain E, Bubner T, Ashwood P, Van Ryswyk E, Simmonds L, Reid S, Middleton P, Crowther CA.

BACKGROUND: Strong evidence supports administration of magnesium sulphate prior to birth at less than 30 weeks' gestation to prevent very preterm babies dying or developing cerebral palsy. This study was undertaken as part of The WISH (Working to Improve Survival and Health for babies born very preterm) Project, to assess health professionals' self-reported use of antenatal magnesium sulphate, and barriers and enablers to implementation of 2010 Australian and New Zealand clinical practice guidelines. METHODS: Semi-structured, one-to-one interviews were conducted with obstetric and neonatal consultants and trainees, and midwives in 2011 (n = 24) and 2012-2013 (n = 21) at the Women's and Children's Hospital, South Australia. Transcribed interview data were coded using the Theoretical Domains Framework (describing 14 domains related to behaviour change) for analysis of barriers and enablers.

RESULTS: In 2012-13, health professionals more often reported 'routinely' or 'sometimes' administering or advising their colleagues to administer magnesium sulphate for fetal neuroprotection (86 % in 2012-13 vs. 46 % in 2011). 'Knowledge and skills', 'memory, attention and decision processes', 'environmental context and resources', 'beliefs about consequences' and 'social influences' were key domains identified in the barrier and enabler analysis. Perceived barriers were the complex administration processes, time pressures, and the unpredictability of preterm birth. Enablers included education for staff and women at risk of very preterm birth, reminders and 'prompts', simplified processes for administration, and influential colleagues. CONCLUSIONS: This study has provided valuable data on barriers and enablers to implementing magnesium sulphate for fetal neuroprotection, with implications for designing and modifying future behaviour change strategies, to ensure optimal uptake of this neuroprotective therapy for very preterm infants.

[PMID: 26283623](#)

**20. J Korean Neurosurg Soc. 2015 Jul;58(1):14-21. doi: 10.3340/jkns.2015.58.1.14. Epub 2015 Jul 31.**

**The Effect of Early Intervention and Rehabilitation in the Expression of Aquaporin-4; and Ultrastructure Changes on Rat's Offspring's Damaged Brain Caused by Intrauterine Infection.**

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OBJECTIVE: To study the effect of early intervention and rehabilitation in the expression of aquaporin-4 and ultrastructure changes on cerebral palsy pups model induced by intrauterine infection. METHODS: 20 pregnant Wistar rats were consecutively injected with lipopolysaccharide intraperitoneally. 60 Pups born from lipopolysaccharide group were randomly divided into intervention group (n=30) and non-intervention group (n=30);

intervention group further divided into early intervention and rehabilitation group (n=10), acupuncture group (n=10) and consolidate group (n=10). Another 5 pregnant rats were injected with normal saline intraperitoneally; 30 pups born from the normal saline group were taken as control group. The intervention group received early intervention, rehabilitation and acupuncture treatment. The motor functions of all pups were assessed via suspension test and modified BBB locomotor score. Aquaporin-4 expression in brain tissue was studied through immunohistochemical and western-blot analysis. Ultrastructure changes in damaged brain and control group were studied electron-microscopically. **RESULTS:** The scores of suspension test and modified BBB locomotor test were significantly higher in the control group than the intervention and non intervention group ( $p<0.01$ ); higher in the intervention group than the non-intervention group ( $p<0.01$ ). The expression of Aquaporin-4 was lower in intervention and non intervention group than in the control group ( $p<0.01$ ); also lower in non-intervention group than the intervention group ( $p<0.01$ ). Marked changes were observed in ultrastructure of cortex and hippocampus CA1 in brain damaged group. **CONCLUSION:** Early intervention and rehabilitation training can improve the motor function in offspring with brain injury and reduce the expression of aquaporin-4 in damaged brain.

[PMID: 26279808](#)