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Professor Nadia Badawi AM

Macquarie Group Foundation Chair of Cerebral Palsy

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Interventions and Management

1. **J Bone Joint Surg Am. 2015 Apr 1;97(7):529-36. doi: 10.2106/JBJS.M.01577.**

Tendon transfer surgery in upper-extremity cerebral palsy is more effective than botulinum toxin injections or regular, ongoing therapy.

Van Heest AE1, Bagley A2, Molitor F2, James MA2.

BACKGROUND: For children with upper-extremity cerebral palsy (CP) who meet standard indications for tendon transfer surgery, we hypothesized that surgical treatment would result in greater functional improvement than treatment with botulinum toxin injections or regular, ongoing therapy. **METHODS:** Thirty-nine children with upper-extremity CP, who were four to sixteen years of age and surgical candidates for the transfer of the flexor carpi ulnaris to the extensor carpi radialis brevis, pronator teres release, and extensor pollicis longus rerouting with adductor pollicis release, were prospectively assigned, either randomly (twenty-nine patients) or by patient/family preference (ten patients), to one of three treatment groups: surgical treatment (Group 1); botulinum toxin injections (Group 2); or regular, ongoing therapy (Group 3). Seven centers participated. Assessment measurements included active range of motion, pinch and grip strength, stereognosis, and scores as measured with eight additional functional or patient-oriented outcome instruments. Thirty-four patients (twenty-five randomized and nine from the patient-preference arm) were evaluated twelve months post-treatment as the study cohort. **RESULTS:** For the primary outcome of the Shriners Hospital Upper Extremity Evaluation (SHUEE) dynamic positional analysis (DPA), significantly greater improvement was seen in Group 1 than in the other two groups ($p < 0.001$). Improvements in SHUEE DPA reflected improved supination and wrist extension during functional activities after surgical treatment. Group 1 showed more improvement in the Pediatric Quality of Life Inventory (PedsQL) CP module domain of movement and in the Canadian Occupational Performance Measure (COPM) score for satisfaction than Groups 2 and 3. Both Groups 1 and 3 showed more improvement in pinch strength than did Group 2. **CONCLUSIONS:** For children with upper-extremity CP who were candidates for standard tendon transfer, surgical treatment was demonstrated to provide greater improvement, of modest magnitude, than botulinum toxin injections or regular, ongoing therapy at twelve months of follow-up for the SHUEE DPA, the PedsQL CP module domain of movement, and COPM satisfaction.

LEVEL OF EVIDENCE: Therapeutic Level II. See Instructions for Authors for a complete description of levels of evidence.

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2. J Korean Med Sci. 2015 Apr;30(4):489-94. doi: 10.3346/jkms.2015.30.4.489. Epub 2015 Mar 19.**Perioperative complications of orthopedic surgery for lower extremity in patients with cerebral palsy.**

Lee SY1, Sohn HM2, Chung CY3, Do SH2, Lee KM3, Kwon SS4, Sung KH5, Lee SH3, Park MS3.

Because complications are more common in patients with cerebral palsy (CP), surgeons and anesthesiologists must be aware of perioperative morbidity and be prepared to recognize and treat perioperative complications. This study aimed to determine the incidence of and risk factors for perioperative complications of orthopedic surgery on the lower extremities in patients with CP. We reviewed the medical records of consecutive CP patients undergoing orthopedic surgery. Medical history, anesthesia emergence time, intraoperative body temperature, heart rate, blood pressure, immediate postoperative complications, Gross Motor Function Classification System (GMFCS) level, Cormack-Lehane classification, and American Society of Anesthesiologists physical status classification were analyzed. A total of 868 patients was included. Mean age at first surgery was 11.8 (7.6) yr. The incidences of intraoperative hypothermia, absolute hypotension, and absolute bradycardia were 26.2%, 4.4%, and 20.0%, respectively. Twenty (2.3%) patients had major complications, and 35 (4.0%) patients had minor complications postoperatively. The incidences of intraoperative hypothermia, absolute hypotension, and major postoperative complications were significantly higher in patients at GMFCS levels IV and V compared with patients at GMFCS levels I to III ($P < 0.001$). History of pneumonia was associated with intraoperative absolute hypotension and major postoperative complications ($P < 0.001$). These results revealed that GMFCS level, patient age, hip reconstructive surgery, and history of pneumonia are associated with adverse effects on intraoperative body temperature, the cardiovascular system, and immediate postoperative complications.

[PMID: 25829819](#) [PubMed - in process] PMID: PMC4366972 Free PMC Article

3. Bone Joint J. 2015 Apr;97-B(4):564-71. doi: 10.1302/0301-620X.97B4.34887.**The transverse Vulpius gastrocsoleus recession for equinus gait in children with cerebral palsy.**

Tinney A1, Thomason P2, Sangeux M2, Khot A3, Graham HK3.

We report the results of Vulpius transverse gastrocsoleus recession for equinus gait in 26 children with cerebral palsy (CP), using the Gait Profile Score (GPS), Gait Variable Scores (GVS) and movement analysis profile. All children had an equinus deformity on physical examination and equinus gait on three-dimensional gait analysis prior to surgery. The pre-operative and post-operative GPS and GVS were statistically analysed. There were 20 boys and 6 girls in the study cohort with a mean age at surgery of 9.2 years (5.1 to 17.7) and 11.5 years (7.3 to 20.8) at follow-up. Of the 26 children, 14 had spastic diplegia and 12 spastic hemiplegia. Gait function improved for the cohort, confirmed by a decrease in mean GPS from 13.4° pre-operatively to 9.0° final review ($p < 0.001$). The change was 2.8 times the minimal clinically important difference (MCID). Thus the improvements in gait were both clinically and statistically significant. The transverse gastrocsoleus recession described by Vulpius is an effective procedure for equinus gait in selected children with CP, when there is a fixed contracture of the gastrocnemius and soleus muscles. Cite this article: Bone Joint J 2015;97-B:564-71.

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[PMID: 25820899](#) [PubMed - in process]

4. Dev Neurorehabil. 2015 Apr 2:1-6. [Epub ahead of print]**Robot-assisted gait training might be beneficial for more severely affected children with cerebral palsy: Brief report.**

van Hedel HJ1, Meyer-Heim A, Rüsç-Bohtz C.

PURPOSE: Robot-assisted gait training (RAGT) can complement conventional therapies in children with cerebral palsy. We investigated changes in walking-related outcomes between children with different Gross Motor Function Classification System (GMFCS) levels and the dose-response relationship. **METHODS:** Data from 67 children (3.9-19.9 years) with GMFCS levels II-IV were evaluated retrospectively. Every child received RAGT with the Lokomat

complementing a multidisciplinary rehabilitation program. Changes in various walking-related outcomes were assessed. **RESULTS:** Walking-related outcomes did not improve differently between GMFCS level groups. Significant within-group improvements were mainly observed in children with GMFCS level IV. A dose-response relationship was present for children with GMFCS levels III and IV. **CONCLUSIONS:** Our results indicated that, although children with a GMFCS level IV walked less during an average Lokomat session, they experienced significant improvements in walking-related outcomes. Further, training dose correlated with changes in walking-related outcomes. However, between-group differences in changes in walking-related outcomes were not significant.

[PMID: 25837449](#) [PubMed - as supplied by publisher]

5. Clin J Sport Med. 2015 Mar 18. [Epub ahead of print]

De Novo Cerebral Palsy Diagnosis in 9-Year-Old Soccer Player Presenting With Knee Pain.

Ouellet J1, Jevremovic T.

A 9-year-old boy presented to our outpatient specialized sport and exercise medicine clinic complaining of a subacute onset of unilateral knee pain, after an increased level of soccer training. His knee examination was unremarkable. However, he demonstrated significant tenderness on palpation of his ipsilateral hip flexor and adductor tendons. Abnormalities in muscle tone and difficulty in relaxing and resisting the examiner properly were noted and lead to a complete neurological examination. It demonstrated multiple abnormalities such as increased tone and deep tendon reflexes, greater in lower than upper extremities, and abnormal patterning. A mild form of spastic diplegia was suspected and the patient was referred to a pediatric neurologist who confirmed our initial diagnosis. This case draws attention to the importance of maintaining a high level of suspicion for milder forms of diseases that can go unnoticed for years.

[PMID: 25831409](#) [PubMed - as supplied by publisher]

6. Pediatr Exerc Sci. 2015 Feb;27(1):34-8. doi: 10.1123/pes.2015-0033.

Biomechanics and exercise B. Measuring and understanding spasticity in children with cerebral palsy.

O'Brien TD1.

[PMID: 25822964](#) [PubMed - in process]

7. Pediatr Phys Ther. 2015 Summer;27(2):187-9. doi: 10.1097/PEP.000000000000137.

Update of the core set of exercise tests for children and adolescents with cerebral palsy.

Verschuren O1, Balemans AC.

[PMID: 25822360](#) [PubMed - in process]

8. Pediatr Phys Ther. 2015 Summer;27(2):207-14. doi: 10.1097/PEP.000000000000143.

Functional movement, strength, and intervention for an adolescent with cerebral palsy.

Hedgecock JB1, Rapport MJ, Sutphin AR.

BACKGROUND AND PURPOSE: This case report describes the examination, intervention, and outcome of a 3-month episode of physical therapy (PT) using combined functional training and progressive resistance exercise for an adolescent with cerebral palsy. **SUMMARY OF KEY POINTS:** The patient presented with a long history of PT intervention and strength impairments that limited functional and transitional movement, agility, and peer-level participation in school and the community. Functional strength, aerobic conditioning, and anaerobic power were

examined and addressed during intervention. STATEMENT OF CONCLUSIONS: Lower extremity strength was improved. Improvements in functional strength, agility, and anaerobic power generation were clinically insignificant. Most importantly, patient defined participation improved and was accompanied by achievement of new transitional and functional movements. RECOMMENDATIONS FOR CLINICAL PRACTICE: Outcomes described support the use of progressive resistance exercise and functional training to improve strength and functional mobility in an adolescent with cerebral palsy.

[PMID: 25822362](#) [PubMed - in process]

9. Dev Med Child Neurol. 2015 Apr 1. doi: 10.1111/dmcn.12752. [Epub ahead of print]

Assessment of body composition in children with cerebral palsy: a cross-sectional study in Norway.

Finbråten AK1, Martins C, Andersen GL, Skranes J, Brannsether B, Júlíusson PB, Syversen U, Stevenson RD, Vik T.

AIM: The assessment of growth and body composition is challenging in children with cerebral palsy (CP). The aim of this study was to compare clinical assessments of body composition with measurements obtained using dual-energy X-ray absorptiometry (DXA) in this population. METHOD: Knee height, weight, and triceps and subscapular skinfold thickness (SFT) were measured in 47 children with CP (age range 8-18y; 18 females, 29 males). Height was estimated from knee height, and used to calculate body mass index (BMI). Using SFT measurements, body fat percentage was calculated by standard ('Slaughter') and CP-modified ('Gurka') equations and compared with results obtained using DXA. RESULTS: Children with severe gross motor function impairments (Gross Motor Function Classification System [GMFCS] level III or IV) exhibited stunted growth and had higher fat percentages and lower lean body mass than children classified in GMFCS level I or II. In 10 children classified as 'thin' according to their BMI (five of whom were assigned thinness grade of 2 or lower), percentage of body fat, as determined by DXA, was normal or high. The Slaughter equations significantly underestimated body fat percentages, whereas the precision of the CP-modified Gurka equations was excellent. INTERPRETATION: In this study, children with CP and severe motor impairments displayed stunted growth, but were not undernourished. Relying solely upon BMIs may be misleading in children with CP. Therefore, clinicians should be encouraged to measure SFT and to calculate body fat percentages using the CP-modified version of the Slaughter equation.

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10. Dev Med Child Neurol. 2015 Apr 1. doi: 10.1111/dmcn.12751. [Epub ahead of print]

Measurement of body composition should become routine in nutritional assessment of children with cerebral palsy.

Sullivan P1.

[PMID: 25827683](#) [PubMed - as supplied by publisher]

11. J Electromyogr Kinesiol. 2015 Mar 16. pii: S1050-6411(15)00037-1. doi: 10.1016/j.jelekin.2015.02.007. [Epub ahead of print]

An examination of motor unit number index in adults with cerebral palsy.

Marciniak C1, Li X2, Zhou P3.

Spinal motor neuron loss may be a factor contributing to weakness in central disorders. The aim of this study was to assess whether motor unit numbers are reduced in the hand musculature of adults with cerebral palsy (CP) using the motor unit number index (MUNIX) technique. In this prospective, case-control study, 10 adults with CP were matched with healthy controls. MUNIX was computed using area and power of voluntary surface hypothenar electromyographic (EMG) signals and the compound muscle action potential (CMAP) recorded with ulnar nerve

stimulation. The motor unit size index (MUSIX) was calculated based on maximum CMAP amplitude and MUNIX value. Gross Motor Function Classification Scale (GMFCS) and Manual Abilities Classification Scale (MACS) levels were rated for CP subjects. MUNIX was significantly lower for CP participants (Mean 167.8 vs. 214.4, $p=.022$). MUNIX values did not correlate with GMFCS or MACS. MUSIX values were higher, though not significantly, for CP subjects ($p=.11$). MUSIX increased with increasing MACS levels ($r^2=.4017$, $p=.049$). Thus, motor unit numbers in ulnar hand muscles may be decreased with CP. MUSIX values are associated with greater hand impairment. Therefore, peripheral motor unit loss as a component of the weakness found with CP deserves further evaluation.

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12. Arch Phys Med Rehabil. 2015 Mar 30. pii: S0003-9993(15)00284-1. doi: 10.1016/j.apmr.2015.03.012. [Epub ahead of print]

Bone density in premenopausal women and men under 50 years of age with cerebral palsy.

Fowler EG1, Rao S2, Nattiv A3, Heberer K4, Oppenheim WL4.

OBJECTIVE: To determine bone mineral density (BMD) Z-scores in adults with cerebral palsy (CP), an understudied population. **DESIGN:** Cross-sectional Setting: Medical facility Participants: Forty-eight adults (age = 34.3 ± 5.8 , range = 25-46 years) with CP. **MAIN MEASURES:** Gross Motor Function Classification System (GMFCS), BMD Z-scores at the lumbar spine and hip using dual-energy X-ray absorptiometry (DXA), body mass index (BMI) and ambulatory status. **RESULTS:** Mean BMD Z-scores were -1.40 for the lumbar spine, -1.36 for the total hip, and -1.02 for the femoral neck. Z-scores were significantly lower for the non-ambulatory group at all three sites ($P < .05$). Significant differences were found among GMFCS levels for the lumbar spine and total hip Z-scores ($P < .05$). At the lumbar spine, the mean Z-score for level V (the lowest mobility level) was significantly lower than the mean for levels I/II ($P=.001$), III ($P=.002$), and IV ($P=.013$). For the total hip, the mean Z-score for level V was significantly lower than level I/II ($P=.045$). A significant positive relationship between Z-score and age was found for the lumbar spine ($r_s=.40$, $P=.005$). Significant positive relationships between BMI and Z-scores were found for all sites ($P < .05$). **CONCLUSIONS:** This study contributes to the sparse literature about bone health in adults with CP. In contrast to pediatric data, Z-scores did not decrease as a function of age in this adult cohort. This information is important for clinicians considering treatment options for this population.

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13. Dev Neurorehabil. 2015 Mar 31:1-7. [Epub ahead of print]

Systematic review of whole body vibration exercises in the treatment of cerebral palsy: Brief report.

Sá-Caputo DC1, Costa-Cavalcanti R, Carvalho-Lima RP, Arnóbio A, Bernardo RM, Ronikeile-Costa P, Kutter C, Giehl PM, Asad NR, Paiva DN, Pereira HV, Unger M, Marin PJ, Bernardo-Filho M.

OBJECTIVE: Whole body vibration (WBV) is increasingly being used to improve balance and motor function and reduce the secondary complications associated with cerebral palsy (CP). The purpose of this study was to systematically appraise published research regarding the effects of static and/or dynamic exercise performed on a vibrating platform on gait, strength, spasticity and bone mineral density (BMD) within this population. **METHODS:** Systematic searches of six electronic databases identified five studies that met our inclusion criteria (2 at Level II and 3 at Level III-2). Studies were analysed to determine: (a) participant characteristics; (b) optimal exercise and WBV treatment protocol; (c) effect on gait, strength, spasticity and BMD; and (d) the outcome measures used to evaluate effect. As data was not homogenous a meta-analysis was not possible. **RESULTS:** Several design limitations were identified and intervention protocols are poorly described. The effects on strength, gait, spasticity and BMD in persons with CP remain inconclusive with weak evidence that WBV may improve selected muscle strength and gait parameters and that prolonged exposure may improve BMD; there is currently no evidence that WBV can reduce spasticity. **CONCLUSIONS:** The evidence for exercise performed on a vibrating platform on mobility, strength, spasticity and BMD in CP remains scant and further larger scale investigations with controlled

parameters to better understand the effects of WBV exercises in this population is recommended.

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14. Infant Behav Dev. 2015 Mar 27;39:124-130. doi: 10.1016/j.infbeh.2015.02.005. [Epub ahead of print]

Qualitative elements of early motor development that influence reaching of the erect posture. A prospective cohort study.

Gajewska E1, Sobieska M2.

The proposed assessment sheet aims to show in detail, which qualitative elements of motor performance are performed correctly in the 2nd month of life by children who in the 9th month reached the erect posture. Similar analysis was performed for the qualitative assessment in the 6th month. The prospective investigation of motor development involved a group of 109 children (40 girls and 69 boys). The study was based on the previously described quantity and quality assessment sheet of motor performance, validated for the 2nd and 6th month. Final investigation took place in the 9th month of life and was based on a neurological assessment. It could be shown that a completely correct assessment at the age of 2 months precludes future severe motor development disorders, especially cerebral palsy, although it does not rule out a slight delay. Prematurity and the analyzed risk factors, particularly IVH, impair the motor performance. The absence of axial symmetry, the shoulders protraction and improper position of the pelvis are the most important alarming features at the 2nd month. Distal elements observed in the prone position at the 6th month show a good prognosis for the motor performance in the 9th month. Any abnormalities, mainly related to the body axis and symmetry observed at 2 months of age should encourage one to put a child under observation.

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15. Dev Neurorehabil. 2015 Apr 2:1-9. [Epub ahead of print]

Strengths and challenges faced by school-aged children with unilateral CP described by the Five To Fifteen parental questionnaire.

Forsman L1, Eliasson AC.

PURPOSE: The purpose of this study was to describe motor and non-motor (e.g. cognitive, social, and behavioral) challenges faced in daily life by children with unilateral cerebral palsy (UCP). **METHODS:** In this cross-sectional study, parents completed the Five to Fifteen questionnaire and provided demographic information for 46 children aged 6-15 years (mean 11.01 ± 2.89 SD). **RESULTS:** Most children were reported to have problems in both motor and non-motor domains, ranging from 20 to 92% depending on the domain. Perception and learning were the non-motor functions most commonly reported as challenging (63 and 65%, respectively). The total number of problems was significantly higher in age groups above 9 years. The correlation between all domains was high, but was consistently higher with the fine motor sub-domain, which could be used to predict executive function, perception, memory, and learning outcomes (R²=0.502, 0.642, 0.192, 0.192). **CONCLUSION:** Most children with CP have everyday challenges beyond their primary motor deficiencies.

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16. Vaccine. 2015 Mar 30. pii: S0264-410X(15)00358-8. doi: 10.1016/j.vaccine.2015.03.050. [Epub ahead of print]

Influenza vaccination in children with neurologic or neurodevelopmental disorders.

Smith M1, Peacock G2, Uyeki TM3, Moore C2.

BACKGROUND: Children with neurologic or neurodevelopmental disorders (NNDDs) are at increased risk of

complications from influenza. Although the Advisory Committee on Immunization Practices (ACIP) has recognized NNDDs as high-risk conditions for influenza complications since 2005, little is known about influenza vaccination practices in this population. **METHODS:** CDC collaborated with Family Voices, a national advocacy group for children with special healthcare needs, to recruit parents of children with chronic medical conditions. Parents were surveyed about their knowledge, attitudes, and practices surrounding influenza vaccination. The primary outcome of interest was parental report of vaccination, or intent to vaccinate, at the time of survey participation. CDC also collaborated with the American Academy of Pediatrics to recruit primary care and specialty physicians who provide care for high-risk children, specifically those with neurologic conditions. The primary outcome was physician recognition of ACIP high-risk influenza conditions. **RESULTS:** 2138 surveys were completed by parents of children with high-risk conditions, including 1143 with at least one NNDD. Overall, 50% of children with an NNDD were vaccinated, or their parents planned to have them vaccinated against influenza. Among all 2138 children, in multivariable analysis, the presence of a respiratory condition and prior seasonal influenza vaccination was significantly associated with receipt or planned current season influenza vaccination, but the presence of an NNDD was not. 412 pediatricians completed the provider survey. Cerebral palsy was recognized as a high-risk influenza condition by 74% of physician respondents, but epilepsy (51%) and intellectual disability (46%) were less commonly identified. **CONCLUSIONS:** Our estimates of influenza vaccination in children with NNDDs are comparable to published reports of vaccination in healthy children, which continue to be suboptimal. Education of parents of children with NNDDs and healthcare providers about influenza and the benefit of annual influenza vaccination is needed.

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17. Ultrasound Med Biol. 2015 Mar 24. pii: S0301-5629(15)00199-4. doi: 10.1016/j.ultrasmedbio.2015.02.007. [Epub ahead of print]

Ultrasound Imaging for Analyzing Lateral Tongue Movements during Mastication in Adults with Cerebral Palsy Compared with Adults without Oral Motor Disabilities.

Remijn L1, Weijers G2, Nijhuis-van der Sanden MW3, Groen BE4, de Korte CL2.

Described here is an ultrasound technique used to study tongue movements, particularly lateral tongue movements, during mastication. A method to analyze spatial and temporal tongue movements was developed, and the feasibility of using this method was evaluated. Biplane ultrasound images of tongue movements of four adults without oral motor disability and two adults with oral motor disability as a result of cerebral palsy, were acquired. Tongue movements were analyzed in the coronal and sagittal planes using B-mode and M-mode ultrasonography. Inter-rater and intra-rater agreement for manual tracing of tongue contours was good (ICC = 0.81 and 0.84, respectively). There were significant differences between the two adult groups in movement frequency in the horizontal direction in both coronal and sagittal planes. In the coronal plane, differences in movement frequency and range of vertical movement were detected. Data obtained from sagittal images, with the exception of vertical frequency, indicated no differences between the groups. The protocol developed in this study (using B-mode and M-mode) proved to be valid and reliable. By using this protocol with individuals with and without oral motor disability, we were able to illustrate the clinical application of our protocol to evaluation of differences in tongue movements during mastication.

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Prevention and Cure

18. Mol Cell Neurosci. 2015 Mar 28. pii: S1044-7431(15)00048-2. doi: 10.1016/j.mcn.2015.03.019. [Epub ahead of print]

Delayed post-treatment with bone marrow-derived mesenchymal stem cells is neurorestorative of striatal medium-spiny projection neurons and improves motor function after neonatal rat hypoxia-ischemia.

Cameron SH1, Alwakeel AJ1, Goddard L1, Hobbs CE1, Gowing EK1, Barnett ER1, Kohe SE1, Sizemore RJ1, Oorschot DE2.

Perinatal hypoxia-ischemia is a major cause of striatal injury and may lead to cerebral palsy. This study investigated whether delayed administration of bone marrow-derived mesenchymal stem cells (MSCs), at one week after neonatal rat hypoxia-ischemia, was neurorestorative of striatal medium-spiny projection neurons and improved motor function. The effect of a subcutaneous injection of a high-dose, or a low-dose, of MSCs was investigated in stereological studies. Postnatal day (PN) 7 pups were subjected to hypoxia-ischemia. At PN14, pups received treatment with either MSCs or diluent. A subset of high-dose pups, and their diluent control pups, were also injected intraperitoneally with bromodeoxyuridine (BrdU), every 24h, on PN15, PN16 and PN17. This permitted tracking of the migration and survival of neuroblasts originating from the subventricular zone into the adjacent injured striatum. Pups were euthanized on PN21 and the absolute number of striatal medium-spiny projection neurons was measured after immunostaining for DARPP-32 (dopamine- and cAMP-regulated phosphoprotein-32), double immunostaining for BrdU and DARPP-32, and after cresyl violet staining alone. The absolute number of striatal immunostained calretinin interneurons was also measured. There was a statistically significant increase in the absolute number of DARPP-32-positive, BrdU/DARPP-32-positive, and cresyl violet-stained striatal medium-spiny projection neurons, and fewer striatal calretinin interneurons, in the high-dose MSC group compared to their diluent counterparts. A high-dose of MSCs restored the absolute number of these neurons to normal uninjured levels, when compared with previous stereological data on the absolute number of cresyl violet-stained striatal medium-spiny projection neurons in the normal uninjured brain. For the low-dose experiment, in which cresyl violet-stained striatal medium-spiny neurons alone were measured, there was a lower statistically significant increase in their absolute number in the MSC group compared to their diluent controls. Investigation of behavior in another cohort of animals showed that delayed administration of a high-dose of bone marrow-derived MSCs, at one week after neonatal rat hypoxia-ischemia, improved motor function on the cylinder test. Thus, delayed therapy with a high- or low-dose of adult MSCs, at one week after injury, is effective in restoring the loss of striatal medium-spiny projection neurons after neonatal rat hypoxia-ischemia and a high-dose of MSCs improved motor function.

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19. Neurology. 2015 Mar 27. pii: 10.1212/WNL.0000000000001494. [Epub ahead of print]

Copy number variations in cryptogenic cerebral palsy.

Segel R1, Ben-Pazi H2, Zeligson S2, Fatal-Valevski A2, Aran A2, Gross-Tsur V2, Schneebaum-Sender N2, Shmueli D2, Lev D2, Perlberg S2, Blumkin L2, Deutsch L2, Levy-Lahad E2.

OBJECTIVE: To determine the prevalence and characteristics of copy number variations (CNVs) in children with cerebral palsy (CP) of unknown etiology, comprising approximately 20% of the CP population. **METHODS:** Fifty-two participants (age 10.5 ± 7.8 years; Gross Motor Function Classification System scale 2.8 ± 1.3) with nonprogressive pyramidal and/or extrapyramidal signs since infancy and no identified etiology were enrolled. Individuals with evidence of acquired causes were excluded. Participants underwent neurologic and clinical genetic examinations before the genomic testing. Chromosomal microarray analysis to detect CNVs was performed using the Affymetrix platform. CNVs identified were classified as pathogenic, likely pathogenic, likely benign, or benign. Only pathogenic and likely pathogenic CNVs were defined as clinically significant. **RESULTS:** Thirty-nine CNVs were found in 25 of 52 participants (48%). Sixteen participants (31%) had clinically significant CNVs: 10 pathogenic and 6 likely pathogenic, of which 7 were not previously associated with motor disability. Nine participants had likely benign CNVs. Clinically significant CNVs were more frequently de novo (12/16; $p < 0.001$) including in 5 of 8 individuals

who had a first- or second-degree relative with a major neurologic disorder. Dysmorphic features and nonmotor comorbidities were more prevalent in individuals with clinically significant CNVs ($p < 0.05$ for both). **CONCLUSION:** CNVs, most frequently de novo, are common in individuals with cryptogenic CP. We recommend CNV testing in individuals with CP of unknown etiology.

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20. J Paediatr Child Health. 2015 Apr;51(4):464-5. doi: 10.1111/jpc.12865_3.

Familial risk of cerebral palsy.

[No authors listed]

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