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## Interventions and Management

### 1. *Dev Med Child Neurol.* 2016 Aug 9. doi: 10.1111/dmcn.13216. [Epub ahead of print]

'Remind-to-move' treatment versus constraint-induced movement therapy for children with hemiplegic cerebral palsy: a randomized controlled trial.

Dong VA, Fong KN, Chen YF, Tseng SS, Wong LM.

**AIM:** To evaluate 'remind-to-move' (RTM) treatment by comparing it with constraint-induced movement therapy (CIMT) and conventional rehabilitation of the upper extremity in children with hemiplegic cerebral palsy (CP). **METHOD:** Seventy-three children (44 males, 29 females; mean age 11y 8mo, standard deviation [SD] 3y 1mo) - with 20, 38, and 15 in Manual Ability Classification System levels I, II, and III respectively - were recruited from three special schools and randomly selected for an RTM (n=25) or CIMT (n=24) programme (for 75h over 3wks) or for conventional rehabilitation (n=24). The Jebsen-Taylor Hand Function Test, the Bruininks-Oseretsky Test of Motor Proficiency (Subtest 3), the Caregiver Functional Use Survey, and arm movement duration captured by accelerometers were used at the baseline, post-test, and 1-month and 3-month follow-ups. **RESULTS:** Both the RTM and CIMT treatments achieved significant gains in manual capacities and spontaneous hand use immediately after the intervention compared with conventional rehabilitation, but there were no significant differences between the two interventions. **INTERPRETATION:** The RTM treatment demonstrated similar therapeutic effects with CIMT in manual dexterity and functional hand use, but both interventions were superior to conventional rehabilitation. RTM is recommended as an alternative treatment for the hemiplegic upper extremity in children with CP.

[PMID: 27503605](#)

### 2. *Complement Ther Clin Pract.* 2016 Aug;24:67-72. doi: 10.1016/j.ctcp.2016.05.009. Epub 2016 May 12.

Training postural control and sitting in children with cerebral palsy: Kinesio taping vs. neuromuscular electrical stimulation.

Karabay İ, Doğan A, Ekiz T, Köseoğlu BF, Ersöz M.

**OBJECTIVE:** To elucidate the effects of Kinesio Taping (KT) in addition to neurodevelopmental therapy (NDT) on posture and sitting, and to compare the effects of KT and neuromuscular electrical stimulation (NMES). **MATERIALS-METHODS:** Seventy-five children were randomized into control, KT, and NMES groups. NDT was applied to all children 4 times a week for 4 weeks. In addition, KT and NMES were applied to KT and NMES groups, respectively. Sitting subset of Gross Motor Function Measure (GMFM) and kyphosis levels of the groups were analyzed by two way mixed ANOVA. **RESULTS:** GMFM and kyphosis values improved significantly in all groups (all  $p < 0.01$ ), yet change levels were more prominent in the KT and NMES groups than the control group. Moreover, NMES group showed better improvement. **CONCLUSION:** KT or NMES application for four weeks in addition to NDT is effective on improving kyphosis and sitting. Besides, NMES is more effective than KT.

[PMID: 27502803](#)

**3. J Clin Diagn Res. 2016 Jun;10(6):SC01-5. doi: 10.7860/JCDR/2016/18620.7921. Epub 2016 Jun 1.**

Skeletal Maturation and Mineralisation of Children with Moderate to Severe Spastic Quadriplegia.

Sharawat IK, Sitaraman S.

**INTRODUCTION:** Diminished bone mineral density and delayed skeletal maturation are common in children with spastic quadriplegia. **AIM:** The purpose of our study was to evaluate the Bone Mineral Density (BMD) of children with moderate to severe spastic quadriplegia and its relationship with other variables like nutrition and growth. **MATERIALS AND METHODS:** This was a hospital based, cross-sectional, case-control study. Forty-two (28 males, 14 females) children with spastic quadriplegia and 42 (24 males, 18 females) healthy children were included in the study. BMD of cases and control were measured by Dual Energy X-ray Absorptiometry (DEXA). Radiographs of left hand and wrist of cases and controls were taken and bone age was determined. **RESULTS:** BMD values of upper extremity, lower extremity, thoraco-lumbar spine and pelvis in cases were lower than those of controls ( $p < 0.0001$ ). In children with non severe malnutrition, 75% of the cases had lower bone age than chronological age, whereas all cases with severe malnutrition had lower bone age than chronological age. Step wise regression analysis showed that nutritional status independently contributed to lower BMD values but the BMD values did not correlate significantly with the use of anticonvulsant drugs and presence of physical therapy. **CONCLUSION:** Decreased BMD and delayed bone age is prevalent in children with spastic quadriplegia and nutritional status is an important contributing factor.

[PMID: 27504366](#)

**4. J Phys Ther Sci. 2016 Jul;28(7):2128-31. doi: 10.1589/jpts.28.2128. Epub 2016 Jul 29.**

Effects of concentric and eccentric control exercise on gross motor function and balance ability of paretic leg in children with spastic hemiplegia.

Park SI, Kim MS, Choi JD.

[Purpose] This study examines the effect of concentric and eccentric control training of the paretic leg on balance and gross motor function in children with spastic hemiplegia. [Subjects and Methods] Thirty children with spastic hemiplegia were randomly divided into experimental and control groups. In the experimental group, 20 min of neurodevelopmental therapy and 20 min of concentric and eccentric control exercise were applied to the paretic leg. In the control group, 40 min of neurodevelopmental therapy was applied. The Pediatric Balance Scale test and standing and gait items of the Gross Motor Function Measure were evaluated before and after intervention. [Results] In the experimental group, Gross Motor Function Measure and Pediatric Balance Scale scores statistically significantly increased after the intervention. The control group showed no statistically significant difference in either score after the intervention. [Conclusion] Concentric and eccentric control exercise therapy in children with spastic hemiplegia can be effective in improving gross motor function and balance ability, and can be used to solve functional problems in a paretic leg.

[PMID: 27512281](#)

**5. SAGE Open Med. 2016 Jul 11;4:2050312116658908. doi: 10.1177/2050312116658908. eCollection 2016.**

Preliminary study of novel, timed walking tests for children with spina bifida or cerebral palsy.

Kane KJ, Lanovaz J, Bisaro D, Oates A, Musselman KE.

**OBJECTIVE:** Walking assessment is an important aspect of rehabilitation practice; yet, clinicians have few psychometrically sound options for evaluating walking in highly ambulatory children. The purpose of this study was to evaluate the validity and reliability of two new measures of walking function—the Obstacles and Curb tests—relative to the 10-Meter Walk test and Timed Up and Go test in children with spina bifida or cerebral palsy. **METHODS:** A total of 16 ambulatory children with spina bifida ( $n=9$ ) or cerebral palsy ( $n=7$ ) (9 boys; mean age 7years, 7months; standard deviation 3years, 4months) and 16 age- and gender-matched typically developing children participated. Children completed the walking tests, at both self-selected and fast speeds, twice. To evaluate discriminative validity, scores were compared between typically developing and spina bifida/cerebral palsy groups. Within the spina bifida/cerebral palsy group, inter-test correlations evaluated convergent validity and intraclass correlation coefficients evaluated within-session test-retest reliability. **RESULTS:** At fast speeds, all tests showed

discriminative validity ( $p < 0.006$  for typically developing and spina bifida/cerebral palsy comparisons) and convergent validity ( $\rho = 0.81-0.90$ ,  $p \leq 0.001$ , for inter-test correlations). At self-selected speeds, only the Obstacles test discriminated between groups ( $p = 0.001$ ). Moderately strong correlations ( $\rho = 0.73-0.78$ ,  $p \leq 0.001$ ) were seen between the 10-Meter Walk test, Curb test, and Timed Up and Go test. Intraclass correlation coefficients ranged from 0.81 to 0.97, with higher test-retest reliability for tests performed at fast speeds rather than self-selected speeds. **CONCLUSION:** The Obstacles and Curb tests are promising measures for assessing walking in this population. Performing tests at fast walking speeds may improve their validity and test-retest reliability for children with spina bifida/cerebral palsy.

[PMID: 27493754](#)

#### **6. J Clin Diagn Res. 2016 Jun;10(6):RC01-5. doi: 10.7860/JCDR/2016/17067.7975. Epub 2016 Jun 1.**

Prospective Randomized Study of Oral Diazepam and Baclofen on Spasticity in Cerebral Palsy.

Goyal V, Laisram N, Wadhwa RK, Kothari SY.

**INTRODUCTION:** Spastic cerebral palsy (CP) is the most common form of CP. Diazepam and Baclofen are the most commonly used oral drugs to manage spasticity. Study was designed to evaluate and compare their effects and safety in CP children. **AIM:** Study was aimed to assess and compare outcome of oral Diazepam and Baclofen in spastic cerebral palsy children in terms of extent of reduction of spasticity and side effects profile. **MATERIALS AND METHODS:** Randomized prospective follow-up study was done for one year after giving Diazepam and Baclofen in weekly incremental doses upto recommended maximum dose to 60 children for three months. Two primary outcome measures were spasticity reduction and adverse effect profile. Spasticity reduction was measured by Modified Ashworth's Scale (MAS) and Range of Motion improvement (ROM). **RESULTS:** After random allocation, there was no baseline difference between groups. Mean MAS score improved from  $1.96 \pm 0.4$  at baseline to  $1.63 \pm 0.40$  and  $1.41 \pm 0.36$  at 1 month and 3 months for Diazepam and from  $1.84 \pm 0.64$  to  $1.57 \pm 0.59$  and  $1.31 \pm 0.48$  respectively for Baclofen. Within the group reduction was significant with  $p$ -value = 0.0001. Intergroup comparison showed no statistically significant difference with  $p$ -value of 0.48 and 0.22 at 1 and 3 months. Baseline ROM showed significant improvement at 1 and 3 months with  $p$  value of 0.004 and 0.001 for Diazepam and 0.01 and 0.000 for Baclofen respectively with no statistically significant difference among two groups. Drowsiness was most common observed side effect in both the groups. **CONCLUSION:** Patients showed significant improvement in spasticity as measured by Mean MAS score and range of motion in Diazepam as well as Baclofen group. Both drugs were found safe for use in children. Study couldn't establish any difference between the two drugs. However studies with bigger sample size and longer follow-up assessing functional improvement in patients will be required in near future.

[PMID: 27504360](#)

#### **7. Paediatr Anaesth. 2016 Aug 8. doi: 10.1111/pan.12981. [Epub ahead of print]**

Perioperative complications and outcomes in children with cerebral palsy undergoing scoliosis surgery.

Bendon AA, George KA, Patel D.

**INTRODUCTION:** Neuromuscular scoliosis is a known risk factor for postoperative complications after corrective spine surgery. Few studies have looked at the preoperative factors affecting postoperative complications in children with cerebral palsy. **AIM:** The aim of this study was to examine the factors that might influence postoperative course in patients with cerebral palsy undergoing spine surgery for scoliosis. **METHODS:** Nineteen case notes of children with cerebral palsy who had spine surgery (2008-2014) were reviewed retrospectively. Preoperative comorbidities and postoperative complications were noted and complications were classified as major and minor. **RESULTS:** Thirteen out of 19 (68.4%) patients had two or more systemic comorbidities. Most common comorbidities included reflux and seizure disorder. Nine patients (49%) had at least one major complication. About 5/19 patients had respiratory complications requiring ventilation and 4/19 had massive blood loss. A higher incidence of postoperative major complication was recorded in the group with two systemic comorbidities as compared to those with less than two systemic comorbidities (47% vs 16%). Both patients who had a single-stage anterior release and posterior fixation had a major complication. **CONCLUSION:** Presence of two or more comorbidities and thoracotomy are risk factors for perioperative complications in children with cerebral palsy undergoing surgery for scoliosis correction.

[PMID: 27501478](#)

**8. Clin Rehabil. 2016 Aug 9. pii: 0269215516663286. [Epub ahead of print]**

Medication, rehabilitation and health care consumption in adults with cerebral palsy: A population based study.

Pons C, Brochard S, Gallien P, Nicolas B, Duruflé A, Roquet M, Rémy-Néris O, Garlantezec R.

**OBJECTIVE:** To evaluate medication, rehabilitation and healthcare consumption in adults with CP as a function of Gross Motor Function Classification System (GMFCS) level. **DESIGN:** Questionnaire-based cross-sectional study. **SETTING:** Brittany, a French county. **SUBJECTS:** Adults with cerebral palsy. **INTERVENTIONS:** Questionnaires relating to drugs, orthotic devices, mobility aids, rehabilitation and medical input were sent to 435 members of a unique regional French network dedicated to adults with cerebral palsy. The questionnaire was completed by the participant or a helper if necessary. **RESULTS:** Of the 282 responders, 7.8% had a GMFCS level of I, 14.2% II, 17.7% III, 29.1% IV and 31.2% V. Participants consumed a large amount of healthcare. Almost three-quarters took orally administered drugs, of which antispastic and antiepileptic drugs were among the most frequent. Nearly all patients had at least one type of rehabilitation, 87.2% had physiotherapy, 78% used at least one mobility aid and 69.5% used at least one orthotic device. The frequency of numerous inputs increased with GMFCS level. Specificities were found for each GMFCS level, e.g. participants with GMFCS level IV and V had a high level of medical input and a greater use of trunk-supporting devices, antireflux and laxative. Profiles could be established based on GMFCS levels. **CONCLUSIONS:** Adults with cerebral palsy use a large amount of drugs, mobility aids, orthotic devices, rehabilitation and medical input. Healthcare is targeted at cerebral palsy-related issues. GMFCS is a determinant of healthcare consumption and thus a useful tool for clinical practice to target care appropriately.

[PMID: 27506220](#)

**9. Int J Pediatr Otorhinolaryngol. 2016 Sep;88:173-8. doi: 10.1016/j.ijporl.2016.06.043. Epub 2016 Jun 28.**

The impact of submandibular duct relocation on drooling and the well-being of children with neurodevelopmental disabilities.

Kok SE, van der Burg JJ, van Hulst K, Erasmus CE, van den Hoogen FJ.

**OBJECTIVE:** The aim of this study was to evaluate the impact of a reduction in drooling after bilateral submandibular duct relocation (SMDR) with sublingual gland excision on daily life and care, as well as social and emotional consequences in children and adolescents with neurodevelopmental disabilities. **METHODS:** This prospective cohort study included 72 children and adolescents (46 males, 26 females) with moderate to severe drooling, and their caregivers. Mean age at the time of surgery was 15 years 2 months (SD 4y 3mo). Fifty-two children were diagnosed with cerebral palsy and 20 had other non-progressive developmental disabilities. A caregiver questionnaire to document the impact of drooling on daily care and economic consequences, social interaction and emotional development and self-esteem was administered before, and 8 and 32 weeks after surgery. **RESULTS:** Following bilateral SMDR the mean Visual Analogue Scale (VAS, 0-100) scores demonstrated a significant ( $p < 0.001$ ) reduction in the severity of drooling from 81 at baseline to 28 and 36 after 8 and 32 weeks, respectively. This was accompanied by a decrease in the amount of daily care required and reduced economic consequences. In addition, an increase in social contact with other children and adults was reported by caregivers after surgery. **CONCLUSION:** Bilateral SMDR with sublingual gland excision provides a significant positive reduction in daily care of children suffering from drooling. Caregivers also report positive changes in their child's social interaction and sense of self-esteem.

[PMID: 27497408](#)

**10. Int J Pediatr Otorhinolaryngol. 2016 Sep;88:142-5. doi: 10.1016/j.ijporl.2016.06.031. Epub 2016 Jun 11.**

Botulinum toxin injections for chronic sialorrhoea in children are effective regardless of the degree of neurological dysfunction: A single tertiary institution experience.

Mahadevan M, Gruber M, Bilish D, Edwards K, Davies-Payne D, van der Meer G.

**OBJECTIVE:** To determine the effectiveness of submandibular salivary gland Botulinum Toxin Type-A (BTX-A) injection in the treatment of drooling in children with varying degrees of neurological dysfunction. **METHODS:** A retrospective review of pre- and post-procedure drooling frequency and severity scores of patients receiving BTX-A between January 2008 and January 2013. Stratification to different subgroups of neurological impairment was performed according to Gross Motor Function Classification System (GMFCS) score. Drooling severity was assessed using Thomas-Stonell and Greenberg symptom questionnaires administered at time of initial consultation and 3 months after treatment. **RESULTS:** 48 sets of BTX-A injections in 26 patients with an average age of 9.45 years (range 7 months-18 years) were included in the study. Marked

improvement in drooling was seen in 60.4% of patients, a marginal or brief improvement was seen in 20.8% and there was no improvement in 18.8%. No adverse events were reported following any of the BTX-A injections. BTX-A was safe and effective in the eight patients with pre-existing swallowing dysfunction. Subsequent drooling surgery was performed in 15 (57.7%) of the cohort, all 15 patients responded to BTX-A injections. In patients with Cerebral Palsy, there was no correlation between the severity of the neurological dysfunction as measured by the Gross Motor Function Classification System (GMFCS) score and the response to BTX-A treatment. CONCLUSIONS: Injection of BTX-A to the submandibular glands of children with neurological disorders is a safe procedure and results in a reduction in drooling in the majority of patients. Children with severe neurological dysfunction respond to BTX-A injections as effectively as their less impaired peers and the degree of response does not appear to be associated with the severity of neurological disability. BTX-A injection is a good initial procedure when drooling surgery is being considered.

[PMID: 27497402](#)

### **11. J Pediatr Orthop B. 2016 Aug 6. [Epub ahead of print]**

Risk factors for pancreatitis after posterior spinal fusion in children with cerebral palsy.

Abousamra O, Nishnianidze T, Rogers KJ, Er MS, Sees JP, Dabney KW, Miller F.

This study reports on the prevalence and risk factors of acute pancreatitis after posterior spinal fusion for cerebral palsy scoliosis. Pancreatitis diagnosis was based on elevated amylase or lipase above three times the upper normal limit. Perioperative data were compared between patients with and without pancreatitis. We included 300 patients; 55% developed acute pancreatitis. Gastrostomy dependence was more common in the pancreatitis group ( $P=0.048$ ). Perioperative data were similar between groups. Patients with pancreatitis had longer duration of hospitalization (19 vs. 13 days,  $P<0.001$ ). Acute pancreatitis is common after cerebral palsy scoliosis surgery. Gastrostomy dependence increases its risk. Although no mortality was reported, hospital stay was longer.

[PMID: 27509481](#)

### **12. Int J Rehabil Res. 2016 Aug 9. [Epub ahead of print]**

The use of commercial video games in rehabilitation: a systematic review.

Bonnechère B1, Jansen B, Omelina L, Van Sint Jan S.

The aim of this paper was to investigate the effect of commercial video games (VGs) in physical rehabilitation of motor functions. Several databases were screened (Medline, SAGE Journals Online, and ScienceDirect) using combinations of the following free-text terms: commercial games, video games, exergames, serious gaming, rehabilitation games, PlayStation, Nintendo, Wii, Wii Fit, Xbox, and Kinect. The search was limited to peer-reviewed English journals. The beginning of the search time frame was not restricted and the end of the search time frame was 31 December 2015. Only randomized controlled trial, cohort, and observational studies evaluating the effect of VGs on physical rehabilitation were included in the review. A total of 4728 abstracts were screened, 275 were fully reviewed, and 126 papers were eventually included. The following information was extracted from the selected studies: device type, number and type of patients, intervention, and main outcomes. The integration of VGs into physical rehabilitation has been tested for various pathological conditions, including stroke, cerebral palsy, Parkinson's disease, balance training, weight loss, and aging. There was large variability in the protocols used (e.g. number of sessions, intervention duration, outcome measures, and sample size). The results of this review show that in most cases, the introduction of VG training in physical rehabilitation offered similar results as conventional therapy. Therefore, VGs could be added as an adjunct treatment in rehabilitation for various pathologies to stimulate patient motivation. VGs could also be used at home to maintain rehabilitation benefits.

[PMID: 27508968](#)

**13. J Clin Diagn Res. 2016 Jun;10(6):PD05-6. doi: 10.7860/JCDR/2016/18761.7965. Epub 2016 Jun 1.**

Scalp Haematoma in Cerebral Palsy Case due to Unknown Cause - A Rare Case Report.

Uthamalingam M, Singh DS.

Incidences of cerebral palsy (CP) in children are not quite common even though it is the most common motor disorder in children. Further quality of life in CP cases is not so good in young adult stages and has to face certain problems. However scalp haematoma formation in CP patient without injury to head is rarely been reported. The case is being reported for the first time from Malaysia. We report on a unique case of scalp haematoma in an 18-year-old girl of known CP patient with unknown cause. No history of trauma or fall with any of the focal neurological signs or symptoms was found. Clinical examination showed soft boggy swelling of 8 x 10 cm size, involving most of scalp and upper face. CT - scan showed scalp haematoma with right orbital extraconal lesion. She underwent incision and drainage of scalp lesion; consequently around 100 ml of clotted blood came out. At follow-up she was doing well.

[PMID: 27504347](#)

**14. J Phys Ther Sci. 2016 Jul;28(7):2132-9. doi: 10.1589/jpts.28.2132. Epub 2016 Jul 29.**

A study of the development of the Korean version of PedsQL(TM) 3.0 cerebral palsy module and reliability and validity.

Yun YJ, Shin YB, Kim SY, Shin MJ, Kim RJ, Oh TY.

[Purpose] The purpose of this study was to develop the Korean version of the PedsQL(TM) 3.0 Cerebral Palsy Module to evaluate the health-related quality of life of children with cerebral palsy and to test the reliability and validity. [Subjects and Methods] The study included 108 caregivers of children with cerebral palsy aged 2 to 4 years and 72 caregivers of children aged 5 to 7 years, who visited multiple sites between February and August 2015. The Translation Commission performed the first translation with the approval of the Mapi Research Trust Company to create a Korean-version of the PedsQL(TM). Afterwards, back-translation was performed by one translator specializing in health and medical treatment who was a native English-speaker fluent in Korean, and one native Korean-speaker fluent in English. The consistency of each question was confirmed and a translation-integrated version was created. Test components were explained to caregivers during a one-on-one interview; caregivers then completed the PedsQL(TM) questionnaire and a Pediatric Evaluation Disability Inventory (PEDI) questionnaire. Subjects contributing to test-retest measures were asked to repeat the PedsQL questionnaire one week later and return it by mail. To assess data quality for the survey question results, non-response rate, ceiling effect, and floor effect were analyzed. Test-retest reliability and internal consistency reliability were assessed. For test-retest reliability, an intraclass correlation coefficient (ICC) was calculated, and for internal consistency reliability, Cronbach's alpha was used. To test criterion-related validity, Pearson's correlation coefficient was used. [Results] The content validity of the PedsQL 3.0 Cerebral Palsy Module was high for both age groups, and demonstrated significant internal consistency (>0.7) in all areas. For test-retest reliability, both groups demonstrated a significant ICC (>0.61). Correlation with the PEDI was statistically significant in all areas except pain and hurt. [Conclusion] The Korean version of the PedsQL(TM) 3.0 Cerebral Palsy Module was found to be reliable and valid, and is expected to contribute greatly to the evaluation of the quality of life of children with cerebral palsy.

[PMID: 27512282](#)

## Prevention and Cure

### 15. J Magn Reson Imaging. 2016 Aug 9. doi: 10.1002/jmri.25407. [Epub ahead of print]

Concurrent decrease of brain white matter tracts' thicknesses and fractional anisotropy after antenatal hypoxia-ischemia detected with tract-based spatial statistics analysis.

Drobyshevsky A.

**PURPOSE:** To examine the extent of gray and white matter (WM) injury following global antenatal hypoxia-ischemia (H-I) and resulting in muscle hypertonia in newborns in a rabbit cerebral palsy model. **MATERIALS AND METHODS:** Rabbit dams (n = 15) underwent uterine ischemia procedure resulting in a global fetal H-I at embryonic day 22 (embryonic 22 days gestation). Newborn's brains underwent high resolution diffusion tensor imaging on a 14 Tesla magnet ex vivo. Fractional anisotropy (FA) in brains of hypertonic (n = 9), nonhypertonic (n = 6), and sham control (n = 5) kits were compared voxel-wise using Tract-Based Spatial Statistics (TBSS) approach. Herein, we used a novel method to assess local WM tracts' thicknesses in TBSS analysis and compare between the groups. **RESULTS:** Significant (corrected  $P < 0.05$ ) reduction of WM FA was found in corpus callosum splenium (91.2%), periventricular WM (83.5%), fimbria hippocampi (78.8%), cingulum (81.4%), anterior commissure (95%), internal capsule (83.2%), and optic tract (82.9%) in the hypertonic group. Significant (corrected  $P < 0.05$ ) reduction in WM tracts' thicknesses was found in corpus callosum (73.3%), periventricular WM (82.5%), cingulum (73.4%), bilaterally in the hypertonic group. **CONCLUSION:** WM injury in newborn hypertonic kits 10 days after global fetal H-I is widespread and involves not only motor but also limbic and commissural fibers in multiple regions. WM injury in newborn hypertonic kits is manifested by changes in microstructural properties and decreased FA, as well as reduction of WM volumes, relative to nonhypertonic kits. J. Magn. Reson. Imaging 2016.

[PMID: 27505718](#)