



Monday 23 May 2011

This free weekly bulletin lists the latest research on cerebral palsy (CP), as indexed in the NCBI, PubMed (Medline) and Entrez (GenBank) databases. These articles were identified by a search using the key term "cerebral palsy".

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Interventions

1. *Dev Med Child Neurol.* 2011 May 13. doi: 10.1111/j.1469-8749.2011.03959.x. [Epub ahead of print]

Context therapy: a new intervention approach for children with cerebral palsy.

Darrah J, Law MC, Pollock N, Wilson B, Russell DJ, Walter SD, Rosenbaum P, Galuppi B.

Source: Department of Physical Therapy, Faculty of Rehabilitation Medicine, University of Alberta, Edmonton, AB. School of Rehabilitation Science and CanChild Centre for Childhood Disability Research, McMaster University, Hamilton, ON. Research Excellence Support Team, Alberta Health Services, Calgary, AB. Department of Clinical Epidemiology and Biostatistics and CanChild Centre for Childhood Disability Research, Hamilton, ON. Department of Pediatrics McMaster University and CanChild Centre for Childhood Disability Research, Hamilton. CanChild Centre for Childhood Disability Research, McMaster University, Hamilton, ON, Canada.

Aim: To describe the development of context therapy, a new intervention approach designed for a randomized controlled trial. **Method:** Therapists were trained to change task and environmental factors to achieve parent-identified functional goals for children with cerebral palsy. Therapists did not provide any remediation strategies to change the abilities of the child. Theoretical constructs were developed using dynamic systems theory and the principles of family-centered care. A primary therapist model was used. A three-step intervention strategy was developed. **Results:** Therapists adhered to the treatment protocol. Parents participated in the development of both functional goals and intervention strategies. **Interpretation:** A therapy approach focusing on changing the task and the environment rather than children's impairments can be a viable treatment strategy and merits further investigation. The detailed description of the context therapy approach allows replication by both researchers and clinicians. Such intervention descriptions are an important methodological consideration in rehabilitation research.

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PMID: 21569011 [PubMed - as supplied by publisher]

2. *Physiother Theory Pract.* 2011 May 15. [Epub ahead of print]

An individualized intermittent intensive physical therapy schedule for a child with spastic quadriplegia.

Rahlin M.

Source: Assistant Professor, Department of Physical Therapy, College of Health Professions, Rosalind Franklin University of Medicine and Science, North Chicago, Illinois, USA.

Current research literature supports the use of intensive physical therapy (PT) for children with cerebral palsy (CP) but lacks consensus on the selection of a specific therapy schedule. The purpose of this case report was to describe the use of an individualized intermittent intensive PT schedule for a child with CP who was otherwise seen

following a traditional, two times per week, schedule. The patient was a 4.5-year-old girl with spastic quadriplegia, GMFCS level III. The new schedule was tried over a 3-month period. Each of the 3 months included a 2-week, five times per week intensive therapy phase, followed by a 2-week resting phase. Outcomes were assessed by using the GMFM-66 and by documenting the attainment of functional gross motor skills related to the patient's PT goals. Intervention included TAMO therapy and family instruction. The patient demonstrated a gradual increase in GMFM-66 scores throughout the 9-month period covered by this case report, with the greatest mean change score obtained when the intermittent intensive therapy schedule was used. Acquired skills were retained and even improved during the resting phases. The child's parents expressed their interest in using the new PT schedule in the future.

PMID: 21568817 [PubMed - as supplied by publisher]

3. Res Dev Disabil. 2011 May 16. [Epub ahead of print]

Bimanual force coordination in children with spastic unilateral cerebral palsy.

Smits-Engelsman BC, Klingels K, Feys H.

Source: Department of Biomedical Kinesiology, Faculty of Kinesiology and Rehabilitation Sciences, Katholieke Universiteit Leuven, Leuven, Belgium; Avans+, University for Professionals, Breda, The Netherlands.

In this study bimanual grip-force coordination was quantified using a novel "Gripper" system that records grip forces produced while holding a lower and upper unit, in combination with the lift force necessary to separate these units. Children with unilateral cerebral palsy (CP) (aged 5-14 years, n=12) were compared to age matched typically developing (TD) children (n=23). Compared to TD, the CP-group is much slower and takes 50% more time to generate grip and lift forces with more fixating force before lifting the upper unit. In addition the coordination between forces in both hands is reduced. The CP-group increases the lift force in the upper hand 2.5 times more than the holding force when pulling the two units apart, while this is only 1.5 times in TD. Moreover, the correlation between forces generated in both hands in the CP-group is lower. The lack of fine tuning of the forces, measured by the linearity error is increased, especially when the magnet load keeping the unit together is low. The results indicate an impaired pull-hold synergy between upper and lower hand and the lift force. Bimanual tasks evaluating bimanual grip and lift forces in children with CP and can give us new insights in the underlying force control mechanisms of the spastic hand.

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PMID: 21592724 [PubMed - as supplied by publisher]

4. Chir Main. 2011 May 4. [Epub ahead of print]

Surgical management of the adult spastic hand. [Article in French]

Allieu Y.

Source: Institut montpellierain de chirurgie de la main et du membre supérieur (IMM), La Chancelière, 1133, rue des Bouisses, 34070 Montpellier, France.

The adult spastic hand, of varying causes, but dominated by vascular hemiplegia and brain damage, associates motor disorders and problems of tonus. The variety of forms of brain damage explains the wealth and diversity of the symptoms. These symptoms, often the most serious along with cognitive disorders, justify the expression "central neurological hand". Each case is an individual one. The effect on the hands may be unilateral or bilateral with spasticity involving the fingers/thumb/wrist. The clinical evaluation leading to a decision tree must take into account spasticity, retraction and paralysis, for each muscle. When completed by anesthetic motor blocks, spasticity and/or retraction, damage to extrinsic and/or intrinsic muscles of the fingers may be differentiated. This repeated multidisciplinary evaluation makes it possible to distinguish between "non functional hands", "functional hands" and "potentially functional hands". In the first instance, surgery can only improve the esthetic aspect or facilitate nursing. In the second instance, correcting spasticity may improve function. The treatment of spasticity is based on inhibiting spasticity (by injecting botulinum toxin or surgical motor hyponeurotisation) and reinforcing the non-spastic antagonist muscles via tendon transfer or tenodesis. Surgery is indicated to correct muscular retraction and deformities.

The functional indications are highly selective and their limited results only allow a "supporting hand" to be constructed at best. The non-functional indications lead to a codified intervention whose results will greatly improve the management of these patients.

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PMID: 21592842 [PubMed - as supplied by publisher]

5. Dev Med Child Neurol. 2011 May 18. doi: 10.1111/j.1469-8749.2011.03969.x. [Epub ahead of print]

Does loss of spasticity matter? A 10-year follow-up after selective dorsal rhizotomy in cerebral palsy.

Tedroff K, Löwing K, Jacobson DN, Aström E.

Source: Neuropediatric Unit, Department of Women's and Children's Health, Karolinska Institutet, Astrid Lindgren Children's Hospital, Stockholm, Sweden.

Aim: The aim of this study was to evaluate the long-term effects of selective dorsal rhizotomy (SDR) in children with cerebral palsy (CP). **Method:** Nineteen children (four females, 15 males; mean age 4y 7mo, SD 1y 7mo) with bilateral spastic CP, were prospectively assessed at baseline and 18 months, 3 years, and 10 years after SDR. Assessments included the Modified Ashworth Scale for spasticity, the Gross Motor Function Measure 88 (GMFM-88) and the Wilson gait scale for ambulation, neurological investigations, and passive joint range of motion assessment. A 10-year retrospective chart review was added for orthopaedic surgery after SDR. **Results:** Baseline muscle tone at the hip, knee, and ankle level displayed a high degree of spasticity that normalized after SDR. After 10 years there was a slight recurrence of spasticity at the knee and ankle. Joint range of motion declined from a maximum at 3 years after SDR to the 10-year follow-up. Median ambulatory status was best 3 years after SDR and then declined. The GMFM-88 score increased from the median baseline value of 51 to 66 ($p=0.002$) and 76 ($p<0.001$) at the initial follow-ups. After 10 years there was a decline in gross motor function with a reduction in the GMFM-88 score to 62 ($p=0.022$). Within 10 years, 16 out of 19 patients had a mean of three orthopaedic surgeries (SD 2.8), soft tissue surgery being the most common. **Interpretation:** The spasticity-reducing effect of SDR, although pronounced, did not seem to improve long-term functioning or prevent contractures. This suggests that contracture development in CP is not mediated by spasticity alone.

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PMID: 21585367 [PubMed - as supplied by publisher]

6. Dev Med Child Neurol. 2011 Jun;53(6):553-8. doi: 10.1111/j.1469-8749.2011.03930.x.

No change in calf muscle passive stiffness after botulinum toxin injection in children with cerebral palsy.

Alhusaini AA, Crosbie J, Shepherd RB, Dean CM, Scheinberg A.

Source: Clinical Rehabilitation Sciences Research Group, Faculty of Health Sciences, The University of Sydney, Lidcombe, NSW, Australia. Department of Rehabilitation, The Children's Hospital at Westmead, NSW, Australia.

Aim: Stiffness and shortening of the calf muscle due to neural or mechanical factors can profoundly affect motor function. The aim of this study was to investigate non-neurally mediated calf-muscle tightness in children with cerebral palsy (CP) before and after botulinum toxin type A (BoNT-A) injection. **Method:** Sixteen children with spastic CP (seven females, nine males; eight at Gross Motor Function Classification System level I, eight at level II; age range 4-10y) and calf muscle spasticity were tested before and during the pharmaceutically active phase after injection of BoNT-A. Measures of passive muscle compliance and viscoelastic responses, hysteresis, and the gradient of the torque-angle curve were computed and compared before and after injection. **Results:** Although there was a slight, but significant increase in ankle range of motion after BoNT-A injection and a small, significant decrease in the torque required to achieve plantigrade and 5° of dorsiflexion, no significant difference in myotendinous stiffness or hysteresis were detected after BoNT-A injection. **Interpretation:** Despite any effect on neurally mediated responses, the compliance of the calf muscle was not changed and the muscle continued to offer significant resistance to passive motion of the ankle. These findings suggest that additional treatment approaches are required to

supplement the effects of BoNT-A injections when managing children with calf muscle spasticity.

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PMID: 21574991 [PubMed - in process]

7. *J Appl Physiol.* 2011 May 19. [Epub ahead of print]

Changes of Calf Muscle-Tendon Biomechanical Properties Induced by Passive Stretching and Active Movement Training in Children with Cerebral Palsy.

Zhao H, Wu YN, Hwang M, Ren Y, Gao F, Gaebler-Spira D, Zhang LQ.

Source: Mayo Clinic College of Medicine.

Biomechanical properties of calf muscles and Achilles tendon may be altered considerably in children with cerebral palsy (CP), contributing to childhood disability. It is unclear how muscle fascicles and tendon respond to rehabilitation and contribute to improvement of ankle joint properties. Biomechanical properties of the calf muscle fascicles of both gastrocnemius medialis (GM) and soleus (SOL) including the fascicle length and pennation angle in 7 children with CP were evaluated using ultrasonography combined with biomechanical measurements before and after a six-week treatment of passive stretching and active movement training. The passive force contributions from the GM and SOL muscles were separated using flexed and extended knee positions, and fascicular stiffness was calculated based on the fascicular force-length relation. Biomechanical properties of the Achilles tendon including resting length, cross-sectional area and stiffness were also evaluated. The six-week training induced elongation of muscle fascicles (SOL: 8%, $P=0.018$; GM: 3%, $P=0.018$), reduced pennation angle (SOL: 10%, $P=0.028$; GM: 5%, $P=0.028$), reduced fascicular stiffness (SOL: 17%, $P=0.128$; GM: 21%, $P=0.018$), decreased tendon length (6%, $P=0.018$), increased Achilles tendon stiffness (32%, $P=0.018$), and increased Young's modulus (20%, $P=0.018$). In vivo characterizations of calf muscles and Achilles tendon mechanical properties help us better understand treatment-induced changes of calf muscle-tendon and facilitate development of more effective treatments.

PMID: 21596920 [PubMed - as supplied by publisher]

8. *Dev Med Child Neurol.* 2011 May 18. doi: 10.1111/j.1469-8749.2011.03991.x. [Epub ahead of print]

10-year follow-up after selective dorsal rhizotomy in cerebral palsy.

Steinbok P.

Source: Neurosurgery, University of British Columbia, Vancouver, BC, Canada.

PMID: 21585368 [PubMed - as supplied by publisher]

9. *Dev Med Child Neurol.* 2011 Jun;53(6):486. doi: 10.1111/j.1469-8749.2011.03926.x.

Muscle volume and motor development in spastic cerebral palsy.

Shortland AP.

Source: Guy's & St Thomas' Foundation Trust, King's Health Partners, London, UK.

PMID: 21574987 [PubMed - in process]

11. J Appl Biomech. 2011 May;27(2):99-107.**The gait of children with and without cerebral palsy: work, energy, and angular momentum.**

Russell S, Bennett B, Sheth P, Abel M.

Source: Department of Mechanical and Aerospace Engineering, University of Virginia, Charlottesville, VA.

This paper describes a method to characterize gait pathologies like cerebral palsy using work, energy, and angular momentum. For a group of 24 children, 16 with spastic diplegic cerebral palsy and 8 typically developed, kinematic data were collected at the subjects self selected comfortable walking speed. From the kinematics, the work-internal, external, and whole body; energy-rotational and relative linear; and the angular momentum were calculated. Our findings suggest that internal work represents 53% and 40% respectively of the whole body work in gait for typically developed children and children with cerebral palsy. Analysis of the angular momentum of the whole body, and other subgroupings of body segments, revealed a relationship between increased angular momentum and increased internal work. This relationship allows one to use angular momentum to assist in determining the kinetics and kinematics of gait which contribute to increased internal work. Thus offering insight to interventions which can be applied to increase the efficiency of bipedal locomotion, by reducing internal work which has no direct contribution to center of mass motion, in both normal and pathologic populations.

PMID: 21576717 [PubMed - in process]

11. Eur J Paediatr Neurol. 2011 May 14. [Epub ahead of print]**Vertigo and balance in children - Diagnostic approach and insights from imaging.**

Jahn K.

Source: Department of Neurology and Integrated Center for Research and Treatment of Vertigo, Balance and Ocular Motor Disorders (IFB(LMU)), Ludwig-Maximilians University of Munich, Klinikum Grosshadern, Marchioninstr. 15, 81377 Munich, Germany.

Common causes of vertigo and dizziness in childhood are vestibular migraine and associated syndromes (benign paroxysmal vertigo), unilateral vestibular failure due to labyrinthitis, positioning vertigo, and somatoform syndromes. Although the same spectrum of diseases as in adults can be found, the frequency differs widely. Further, balance disorders not related to vestibular function, like cerebral palsy, can present with dizziness. Vestibular function can reliably be addressed at the bedside by head impulses to test vestibulo-ocular reflex function, ocular motor testing of the central vestibular system, and balance tests for vestibulo-spinal function. Vestibulo-ocular reflex function can now be quantified by recording eye and head movements with high resolution video-oculography (256 Hz) and inertial sensors. Posturographic measures using artificial neuronal networks are used to classify dysbalance. Quantitative gait analysis further helps to distinguish balance disorders caused by e.g. sensory dysfunction or supraspinal disturbances. Recently, functional neuroimaging opened a view to the brain network for the control of posture and locomotion. From frontal cortex the locomotor signal is conveyed via the basal ganglia to the centers for locomotion and postural control in the brainstem tegmentum. The cerebellum is involved in sensory integration and rhythm generation during postural demands. To summarize, most syndromes causing dizziness, vertigo and imbalance can be diagnosed based on history and clinical tests. However, new data from neurophysiology and imaging help to understand the pathophysiology and the therapeutic principles in these disorders.

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PMID: 21571558 [PubMed - as supplied by publisher]

12. Orthop Nurs. 2011 May-Jun;30(3):155-9.**Lower extremity orthoses in children with spastic quadriplegic cerebral palsy: implications for nurses, parents, and caregivers.**

Cervasio K.

Source: Kathleen Cervasio, PhD, EdD(c), ACNS-BC, CCRN, RN, Assistant Professor of Nursing, Long Island University, Brooklyn, NY.

Understanding trends in the prevalence of children with cerebral palsy is vital to evaluating and estimating supportive services for children, families, and caregivers. The majority of children with cerebral palsy require lower extremity orthoses to stabilize their muscles. The pediatric nurse needs a special body of knowledge to accurately assess, apply, manage, teach, and evaluate the use of lower extremity orthoses typically prescribed for this vulnerable population. Inherent in caring for these children is the need to teach the child, the family, and significant others the proper application and care of the orthoses used in hospital and community settings. Nursing literature review does not provide a basis for evidence in designing and teaching orthopaedic care for children with orthoses. A protocol for orthoses management has been developed to assist caregivers to accurately care for children with lower extremity orthotic devices.

PMID: 21597341 [PubMed - in process]

13. Orthopade. 2011 May 21. [Epub ahead of print]**Spastic equinus foot. [Article in German]**

Westhoff B, Weimann-Stahlschmidt K, Krauspe R.

Source: Klinik für Orthopädie und Orthopädische Chirurgie, Universitätsklinikum Düsseldorf, Moorenstraße 5, 40225, Düsseldorf, Deutschland, westhoff@med.uni-duesseldorf.de.

Pes equinus is the most common deformity in cerebral palsy. A primarily dynamic pes equinus without shortening of the calf muscle in many cases turns into a structural pes equinus. This is due to insufficient linear growth of the calf muscle compared to bone growth. Structural pes equinus has to be distinguished from marked, compensatory and forefoot pes equinus. Conservative as well as operative treatment options are often applied in combination or sequentially. In dynamic pes equinus botulinum toxin A is the therapy of choice. Only slight structural pes equinus may improve under botulinum toxin A injection with and without additional casting. Usually, structural pes equinus requires operative treatment or lengthening of the gastrocnemius and/or soleus muscle (operation according to Baumann). Because of its side effect of inducing loss of power of the calf muscle, lengthening of the Achilles tendon should only be performed with caution. Especially in bilateral spastic cerebral palsy, the increased risk of causing talipes calcaneovalgus and crouch gait has to be considered.

PMID: 21598048 [PubMed - as supplied by publisher]

14. Disabil Rehabil. 2011 May 19. [Epub ahead of print]**A preliminary study describing body position in daily life in children with severe cerebral palsy using a wearable device.**

Sato H, Hirai T.

Source: Department of Rehabilitation, Kitasato University School of Allied Health Sciences, Sagami-hara, Japan.

Purpose. The effects of gravity and immobilisation are regarded as factors in the development of spinal deformity in cerebral palsy (CP). This study was to assess the body positions in daily life of children with CP using a wearable device. Method. Four institutionalised children with severe quadriplegic CP participated in this study. Four age-matched children without disability also participated as healthy controls. The participants wore a body position recorder throughout their normal daily activities for a period of 24 h. After the body position data were recorded, the

amount of time spent by each subject in upright, supine, prone, and left and right lateral lying positions and the frequency of positional change were computed. Results. The pattern of body position change in daily life was clearly different among children with CP and between children with CP and healthy controls. Children with CP spent less time in the upright position and remained in one position for longer periods of time than the control children. Conclusions. Twenty-four-hour monitoring could provide quantitative information about body position, the frequency of body position changes and the period of time spent in a preferred body position, with possible implications for preventing spinal deformity.

PMID: 21591970 [PubMed - as supplied by publisher]

15. Dev Med Child Neurol. 2011 May 13. doi: 10.1111/j.1469-8749.2011.03989.x. [Epub ahead of print]

The 220-age equation does not predict maximum heart rate in children and adolescents.

Verschuren O, Maltais DB, Takken T.

Source: Centre of Excellence, Rehabilitation Centre 'De Hoogstraat', Utrecht, the Netherlands. Partner of NetChild, Network for Childhood Disability Research, Utrecht, the Netherlands. University Medical Center, Rudolf Magnus Institute of Neuroscience Department of Rehabilitation, Nursing Science and Sports, Utrecht, the Netherlands. Department of Rehabilitation, Laval University, Quebec City, Quebec, Canada. Centre for Interdisciplinary Research in Rehabilitation and Social Integration, Quebec City, Quebec, Canada. School of Clinical Health Sciences, Department of Physical Therapy Science, Utrecht University, Utrecht, the Netherlands. Child Development & Exercise Center, Wilhelmina Children's Hospital, UMC Utrecht, Utrecht, the Netherlands.

Our primary purpose was to provide maximum heart rate (HR(max)) values for ambulatory children with cerebral palsy (CP). The secondary purpose was to determine the effects of age, sex, ambulatory ability, height, and weight on HR(max). In 362 ambulatory children and adolescents with CP (213 males and 149 females; age range 6-19y; 195 spastic unilateral, 162 spastic bilateral, and five ataxic CP), HR(max) was measured during a 10-m (Gross Motor Function Classification System [GMFCS] levels I and II) or 7.5 m (GMFCS level III) shuttle run test. The mean HR(max) was 194 (SD 9.9) beats per minute (bpm), with a 95% prediction interval between 174 and 214 bpm. No associations were found in HR(max) related to age, sex, ambulatory ability, height, and weight. Since the HR(max) did not vary with age, equations such as 220-age are not appropriate. When direct evaluation of HR(max) with exercise testing is not feasible, we suggest the mean value of 194 bpm be considered as an estimate of HR(max) at the individual level.

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Publication Types: LETTER

16. N Am J Sports Phys Ther. 2010 Jun;5(2):40-6.

Comparison of a double poling ergometer and field test for elite cross country sit skiers.

Forbes SC, Chilibeck PD, Craven B, Bhambhani Y.

BACKGROUND: Sport specific ergometers are important for laboratory testing (i.e. peak oxygen consumption (VO₂)) and out of season training. OBJECTIVES: The purpose of this study was to compare cardiorespiratory variables during exercise on a double poling ergometer to a field test in elite sit skiers. METHODS: Three male and four female athletes from the Canadian National / Developmental team (17-54 years of age, six with complete paraplegia and one with cerebral palsy) completed a field test and a double poling ergometer protocol separated by at least 24 hours. Both protocols consisted of three maximal trials of skiing of three minutes duration separated by 1.5 minutes of rest. A wireless metabolic system and heart rate monitor were used to measure cardiorespiratory responses [peak heart rate, peak VO₂, and peak respiratory exchange ratio (RER)] during each test. Arterialized blood lactate was measured before the beginning of exercise, after each trial and at 5, 10 and 15 minutes post exercise. RESULTS: No significant differences existed between the field and ergometer tests for peak oxygen consumption (VO₂) (field=34.7±5.5 mL·kg⁻¹·min⁻¹ vs. ergometer=33.4±6.9 mL·kg⁻¹·min⁻¹). Significantly higher peak heart rate and

RER were found during the ergometer test. Significantly higher lactates were found during the ergometer test after trial 2 and trial 3. **CONCLUSION:** The double poling ergometer is similar to a field test for evaluating peak VO(2) in elite cross country sit skiers; however, the ergometer test elicits a higher heart rate and anaerobic response.

PMID: 21589660 [PubMed - in process]

17. Open Orthop J. 2011 Mar 24;5:124-33.

Triangle tilt and steel osteotomy: similar approaches to common problems.

Nath RK, Somasundaram C, Mahmooduddin F.

Source: Texas Nerve and Paralysis Institute, 6400 Fannin Street, Suite 2420, Houston, TX 77030, USA.

BACKGROUND: Each year, thousands of children worldwide suffer obstetric brachial plexus nerve injuries resulting not only in primary nerve injury, but also in development of secondary muscle and bone deformities of the shoulder. The triangle tilt surgery has been developed and shown to effectively address these deformities. The triangle tilt procedure was initially designed by the lead author (RKN) to follow the concepts of joint normalization featured in the Steel pelvic osteotomy used to correct developmental dysplasia of the hip joint, and indeed ultimately bears a striking resemblance to the Steel osteotomy. Prior to performing these bony surgical procedures, soft tissue procedures are performed to release the muscle contractures of the shoulder and hip. The purpose of this article is to compare and analyze the similarities between the indications, surgical techniques, involved anatomy, and outcomes of these operative procedures. **METHODS:** A literature review was conducted using PubMed to identify articles pertaining to triangle tilt surgery and the Steel pelvic osteotomy. Functional parameters and surgical strategies were compared. Pre- and post-operative CTs were analyzed to compare anatomical results of the procedures. **RESULTS:** Similarities were found between both procedures in terms of indications, involved anatomy, surgical techniques, and outcomes. The triangle tilt surgery is indicated to correct the developmental dysplasia of the glenohumeral joint in obstetric brachial plexus injury patients. Steel pelvic osteotomy is performed to correct the subluxation and dislocation of the hip innominate bone in patients with congenital dysplasia, cerebral palsy myelodysplasia, and poliomyelitis. The involved anatomy of both procedures is similar in that both involve limb girdles and ball-and-socket joints, namely the shoulder and hip. Both procedures are also triple osteotomies, the triangle tilt involving the acromion, clavicle and scapula while the Steel osteotomy involves the iliac spine, ischial and pubic ramus of the innominate bone. Surgical techniques also bear likenesses in that both can theoretically be done percutaneously. Post-operative CT outcomes of both surgeries showed improved anatomical positioning of the ball-and-socket joint congruency, and therefore better functional outcomes. **DISCUSSION:** The similarities between the triangle tilt surgery and Steel pelvic osteotomy could potentially be useful as a model system in developing other procedures that involve the shoulder and hip. Future clinical applications include the development and implementation of new surgical procedures based on comparisons and adaptations from the hip to the shoulder and vice versa.

PMID: 21584207 [PubMed - in process]

18. Augment Altern Commun. 2011 Jun;27(2):77-90.

"He Cares About Me and I Care About Him." Children's Experiences of Friendship with Peers who use AAC.

Anderson K, Balandin S, Clendon S.

Source: The University of Sydney, Australia.

Typically developing children face multiple challenges in developing friendships with peers who have severe physical disabilities and use augmentative and alternative communication (AAC), especially when these peers experience restrictions in mobility, educational participation, physical access, and communication. In this small qualitative study, six typically developing children were interviewed about their friendships with classmates who have cerebral palsy and use AAC. Data were analyzed according to Riessman's narrative methodology (2008). Overall, participants viewed these friendships positively. In this article, we discuss the main themes that characterized these friendships: communication, learning, helping, and shared time. This knowledge may help to facilitate friendships between children without disabilities and their peers who use AAC within mainstream educational settings.

PMID: 21592003 [PubMed - in process]

19. Phys Occup Ther Pediatr. 2011 May 17. [Epub ahead of print]

Pretend Play of Children with Cerebral Palsy.

Pfeifer LI, Pacciulio AM, Santos CA, Santos JL, Stagnitti KE.

Source: Division of Occupational Therapy, Department of Neuroscience and Behavioral Sciences, Ribeirão Preto Medical School, University of São Paulo, Ribeirão Preto, São Paulo, Brazil.

Background and Purpose: Evaluate self-initiated pretend play of children with cerebral palsy. Method: Twenty pre-school children participated in the study. Pretend play ability was measured by using the child-initiated pretend play assessment culturally adapted to Brazil. Results: There were significant negative correlations between the children's motor severity level and their elaborateness of play with conventional-imaginative and symbolic play materials and a number of object substitutions in symbolic play. This indicated that children with greater motor limitations had diminished play ability. In this sample, 35% of the children showed typical play styles, identified by good scores in elaborate pretend play actions, number of object substitutions, and ability to self-initiate play, whereas 65% showed delay in their play. Implications: The type of pretend play deficits that might be expected in children with cerebral palsy were described. Furthermore, suggested directions for therapeutic intervention to enhance pretend play performance in cerebral palsy children were proposed.

PMID: 21574911 [PubMed - as supplied by publisher]

20. Cien Saude Colet. 2011 Apr;16(4):2099-2106.

Cerebral palsy and Down syndrome: level of parental knowledge and information. [Article in Portuguese]

Ribeiro MF, Barbosa MA, Porto CC.

Source: Departamento de Enfermagem, Centro Técnico-Científico, Pontifícia Universidade Católica de Goiás, Goiânia, GO, 74605-010.

The study sought to identify and analyze research related to knowledge and information received by parents of children with cerebral palsy or Down syndrome about these disabilities. It involves a bibliographical revision limited to the period from 1996 through 2008. Computerized data bases were used to collect information, using the following terms as key words: cerebral palsy, Down syndrome, knowledge and family. Fifty-seven studies were located from which 16 were selected; of these, seven were related to cerebral palsy, four to Down syndrome and five were related to sundry deficiencies. The parents receive little information from the healthcare staff and clearly have many doubts about cerebral palsy and Down syndrome. This makes it very difficult for the parents to assist in the treatment of their children, as well as interfering in educational practices and decision-making. There is a need for educational actions to change this reality. Only one research project sought to implement educational strategies which focused on broadening knowledge among family members about aspects related to Down syndrome. It was concluded that there is an urgent need to conduct research and develop actions that contribute to parents being better informed and more secure about their children's health care.

PMID: 21584451 [PubMed - as supplied by publisher]

21. Clin Linguist Phon. 2011 May 18. [Epub ahead of print]

Electropalatography in the description and treatment of speech disorders in five children with cerebral palsy.

Nordberg A, Carlsson G, Lohmander A.

Source: Division of Speech and Language Pathology, Department of Clinical Neuroscience and Rehabilitation, Institute of Neuroscience and Physiology, Sahlgrenska Academy, University of Gothenburg, Gothenburg, Sweden.

Some children with cerebral palsy have articulation disorders that are resistant to conventional speech therapy. The aim of this study was to investigate whether the visual feedback method of electropalatography (EPG) could be an effective tool for treating five children (mean age of 9.4 years) with dysarthria and cerebral palsy and to explore whether training improved the posteriorly placed articulation of the Swedish dental/alveolar target consonants /t/, /d/, /n/ and /s/ produced in different positions. An EPG analysis was conducted and some of the data were combined with a perceptual analysis. A more anterior placement was seen after treatment for the target sounds. Features of diagnostic importance revealed were unusual tongue-palate contacts, such as double articulation and abnormally retracted articulation. A possible change in stop closure duration was indicated. The results suggest that EPG could be of potential benefit for diagnosing, treating and describing articulation errors associated with cerebral palsy.

PMID: 21591933 [PubMed - as supplied by publisher]

22. Nutr Clin Pract. 2011 Jun;26(3):253-60.

Hypocaloric considerations in patients with potentially hypometabolic disease States.

Magnuson B, Peppard A, Auer Flomenhoft D.

Source: Barbara Magnuson, UK Hospital - H110, 800 Rose Street, Lexington, KY 40536; blmagno0@email.uky.edu.

The provision of nutrition has traditionally been driven by the desire to provide adequate calories. However, over the past decade it has become evident that provision of excess calories can be detrimental to patients' outcomes in both critical care and long-term care settings. This review examines patient populations for whom hypocaloric nutrition can be both appropriate and beneficial. In specific situations, critically ill patients, such as those with obesity, stroke, and spinal cord injury, may have decreased energy requirements. In patients with spinal cord injury, the level of injury significantly correlates with the extent of reduced caloric energy expenditure. Ventilator-dependent patients with amyotrophic lateral sclerosis (ALS) have decreased energy needs; energy expenditure for ALS patients is lower than the predictive equation value. Aging patients will have decreased energy needs relative to a reduction in lean body mass. Patients with cerebral palsy (CP) have significantly lower caloric requirements than anticipated using predictive equations. Patients with CP pose a particular challenge in nutrition assessment. Several studies demonstrate that patients with CP have significantly lower caloric requirements than anticipated using predictive equations; thus, patients with CP benefit from indirect calorimetry. Provision of nutrition for obese patients is briefly addressed, as this is an increasingly important consideration for nutrition support in both the critical care and long-term care settings. When indirect calorimetry is not available, clinicians should remember that most patients will have low resting energy expenditure regardless of functional status and require frequent evaluation during institution of nutrition recommendations to guard against overfeeding and obesity.

PMID: 21586410 [PubMed - in process]

23. Aust Fam Physician. 2011 Apr;40(4):192-6.

Cerebral palsy in childhood.

Reddihough D.

Source: MD, BSc, FRACP, FAFRM, is a paediatrician, Developmental Medicine, Royal Children's Hospital, Clinical Professor, University of Melbourne and group leader, Developmental Disability Research, Murdoch Childrens Research Institute, Melbourne, Victoria.

BACKGROUND: Cerebral palsy is the most common cause of physical disability in childhood. While some children have only a motor disorder, others have a range of problems and associated health issues. **OBJECTIVE:** This article describes the known causes of cerebral palsy, the classification of motor disorders and associated disabilities, health maintenance, and the consequences of the motor disorder. The importance of multidisciplinary assessment and treatment in enabling children to achieve their optimal potential and independence is highlighted. **DISCUSSION:** General practitioners play an important role in the management of children with cerebral palsy. Disability is a life-long problem which impacts on the child, their parents and their siblings. After transition to adult services, the GP may be the only health professional that has known the young person over an extended period, providing im-

portant continuity of care.

PMID: 21597527 [PubMed - in process]

24. Am J Health Syst Pharm. 2011 Jun 1;68(11):1012-4.

Elevated International Normalized Ratio associated with long-term azithromycin therapy in a child with cerebral palsy.

Stork CM, Marraffa JM, Ragosta K, Wojcik SM, Angelino KL.

Purpose: A case of coagulopathy in a pre-adolescent with cerebral palsy that developed after chronic prophylactic antibiotic use is reported. **Summary:** An 11-year-old boy with cerebral palsy was brought to the emergency department experiencing restlessness and decreased oxygen saturation. Evaluation of the patient revealed gallstone-related pancreatitis, with elevated serum amylase and lipase concentrations and abnormal liver function test results. At the time of the initial evaluation, the International Normalized Ratio (INR) was 6.54 (normal range, 0.8-1.2), and the activated partial thromboplastin time was 53.8 seconds (normal range, 24.4-34.8 seconds). The boy's medication history included use of azithromycin 200 mg every other day for about two years for antiinflammatory therapy. On confirmation of the elevated INR 2 hours after the initial evaluation, azithromycin was discontinued, and a single dose of phytonadione 2 mg was administered. About 14 hours after phytonadione administration, the INR had declined to 0.94; 43 hours later, the INR remained within the normal range without further phytonadione therapy. Using the probability scale of Naranjo and colleagues, this case was rated as a probable drug-related adverse event. Previous reports have linked the development of vitamin K deficiency and impaired coagulation to long-term antibiotic use, but not specifically to use of azithromycin or other macrolide antibiotics. **Conclusion:** An elevated INR in a child with cerebral palsy was evidently related to long-term therapy with azithromycin. The abnormal INR normalized after discontinuation of azithromycin and administration of one dose of phytonadione.

PMID: 21593229 [PubMed - in process]

25. Childs Nerv Syst. 2011 May 17. [Epub ahead of print]

The understanding and operative treatment of cerebral palsy at the turn of the twentieth century: Harvey Cushing's early forays into pediatric neurosurgery.

Dmetrichuk JM, Pendleton C, Ahn ES, Quiñones-Hinojosa A.

Source: School of Medicine and Dentistry, University of Aberdeen, Aberdeen, Scotland, UK.

INTRODUCTION: At the turn of the twentieth century, cerebral palsy and its treatment were not well understood, and a variety of treatment modalities were tested with only limited success. **MATERIAL AND METHODS:** Following IRB approval and through the courtesy of the Alan Mason Chesney Archives, we reviewed the Johns Hopkins Hospital surgical files from 1896-1912. Eight patients who received a diagnosis consistent with cerebral palsy and were treated surgically by Dr. Cushing were selected for further analysis and are described here. **RESULTS:** A total of eight patients underwent operative intervention for treatment of symptoms consistent with cerebral palsy. Of these, seven were male; the mean age was 4.9 years (range, 1.5 to 12). Five patients underwent decompressive craniotomies, one underwent tenotomies, one underwent transection of the spinal nerve roots, and one underwent primary transection of the spinal nerve roots with secondary tenotomies. Four representative cases are reported here. **CONCLUSIONS:** Cushing's contributions to pediatric neuro-oncology have been previously described, but his endeavors in non-oncologic realms remain largely unknown. Although Cushing employed previously described operative approaches for the treatment of cerebral palsy, parents brought their children to him from across the nation, in an era when long distance travel was tedious, and a financial burden. These cases serve to emphasize Cushing's interest in improving patient quality of life, and his broad contributions to pediatric neurosurgery.

PMID: 21584747 [PubMed - as supplied by publisher]

26. Indian J Ophthalmol. 2011 May-Jun;59(3):223-8.**Ocular disorders in children with learning disabilities in special education schools of Pune, India.**

Gogate P, Soneji FR, Kharat J, Dulera H, Deshpande M, Gilbert C.

Source: HV Desai Eye Hospital, Pune, Maharashtra, India.

Aim: The aim was to study and treat ocular disorders in children with learning disabilities (cLDs) and explore associations with their perinatal history. **Materials and Methods:** cLDs attending 11 special schools were examined by a team consisting of an ophthalmologist, optometrist, and a social worker in 2007 and followed up in 2008. The students' intelligence quotient (IQ) and their medical histories were noted. Distant visual acuities were measured using Kay pictures or Snellen's tumbling E chart and complete ocular examination was performed. Students were assessed at the pediatric ophthalmology unit and low vision center, if needed. Statistical analysis was done with SPSS and the Chi-square test for ordinal data. **Results:** A total of 664 students were examined, 526 of whom were <16 years of age; 323 (61.4%) were male. A total of 326 (60%) had moderate-to-severe learning disabilities (IQs <50), and the mean IQ was 45.4. Two hundred and thirty-eight (45.3%) had ocular disorder; 143 (27.3%) had an uncorrected refractive error, followed by strabismus in 83 (15.8%), nystagmus in 36 (6.8%), optic atrophy in 34 (6.5%), and congenital anomalies in 13 (2.5%), 103 children had more than one abnormality. Only 12 of the 143 students with refractive errors were using spectacles. A total of 132 (48.7%) children with a history of perinatal insult had ocular problems. Ocular disorders were also common in those with a history of epilepsy, Down's syndrome, and cerebral palsy. **Conclusion:** Nearly half the cLDs in this study had ocular disorders and one-fourth had their vision improved.

PMID: 21586845 [PubMed - in process]

27. Minerva Anestesiol. 2011 May 11. [Epub ahead of print]**Invasive and non-invasive long-term mechanical ventilation in Italian children.**

Racca F, Bonati M, Del Sorbo L, Berta G, Sequi M, Capello EC, Wolfler A, Salvo I, Bignamini E, Ottonello G, Cutrera R, Biban P, Benini F, Ranieri VM.

Source: Department of Pediatric Anesthesia and Resuscitation, SS Antonio Biagio e Cesare Arrigo Hospital, Alessandria, Italy - fabrizio.racca@gmail.com.

BACKGROUND: To date, few studies have been published regarding the number of children in Italy who require long-term mechanical ventilation (LTV) and their underlying diagnoses, ventilatory needs and hospital discharge rate. **METHODS:** A preliminary national postal survey was conducted and identified 535 children from 57 centers. Detailed data were then obtained for 378 children from 30 centers. **RESULTS:** The estimated prevalence in Italy of this population was 4.3/100 000. The majority of children (72.2%) were followed in pediatric units. The primary physicians who cared for these patients were either pediatric intensivists or pediatric pulmonologists. Neurological patients (78.2% of cases) represented the principal disorder category. 57.2% of the patients were non-invasively ventilated, with a nasal mask being the most common interface (85% of cases). The presence of clinical symptoms that were associated with abnormal findings on diagnostic testing was the primary indication for ventilatory support, whereas weaning failure was the primary indication for tracheotomy. Invasive ventilation was significantly related to younger age, longer daily hours on ventilation and cerebral palsy. Ventilatory modes with guaranteed minimal tidal volume were more often used in patients with tracheotomy. Despite their age, illness severity and need for technological care, 98% of the study population were successfully home discharged. **CONCLUSION:** Managing pediatric home LTV requires tremendous effort on the part of the patient's family and places a significant strain on community financial resources. In particular, neurological patients require more health care than patients in other categories. To further improve the quality of care for these patients, it is essential to establish a dedicated national database.

PMID: 21597447 [PubMed - as supplied by publisher]

Epidemiology / Aetiology / Diagnosis & Early Treatment

28. Semin Pediatr Neurol. 2011 Mar;18(1):31-9.

The cerebral palsy demonstration project: a multidimensional research approach to cerebral palsy.

Shevell M, Miller SP, Scherer SW, Yager JY, Fehlings MG.

Source: Departments of Neurology/Neurosurgery and Pediatrics, McGill University, Montreal, Canada.

Cerebral palsy is the most common cause of physical impairment in pediatrics. As a heterogeneous disorder in all its disparate aspects it defies a simplistic research approach that seeks to further our understanding of its mechanisms, outcomes and treatments. Within NeuroDevNet, with its focus on abnormal brain development, cerebral palsy was selected as one of the three neurodevelopmental disabilities to be the focus of a dedicated demonstration project. The Cerebral Palsy Demonstration Project will feature a multi-dimensional approach utilizing epidemiologic, imaging, genetics, animal models and stem cell modalities that will at all times emphasize clinical relevance, translation into practice, and potential synergies between investigators now segregated by both academic disciplines and geographic distance. The objective is to create a national platform of varied complementary and interdigitated efforts. The specific research plan to enable this will be outlined in detail.

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29. Semin Pediatr Neurol. 2011 Mar;18(1):26-30.

Practices and Plans for Knowledge Translation at NeuroDevNet.

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Source: Community Health and Epidemiology, College of Medicine, University of Saskatchewan, and Saskatchewan Population Health and Evaluation Research Unit, University of Saskatchewan, Saskatoon, Saskatchewan, Canada.

Knowledge translation at NeuroDevNet, a new Canadian Network of Centres of Excellence focused on brain development, is a core service that spans its 3 demonstration projects: research programs in cerebral palsy, autism spectrum disorder and fetal alcohol spectrum disorder, and integrated as a network-wide activity. This article describes the results of an environmental scan of NeuroDevNet members using a survey of their existing practices and needs completed by 30% of NeuroDevNet's members (n = 36/120) and key informant interviews with 14 members. Results suggest that most members are somewhat engaged in a number of knowledge translation activities although they tend to be traditional ones, such as attending conferences and giving presentations to other researchers. There is very little in the way of public engagement or consumer-focused activities. It also describes activities underway at the Cerebral Palsy Demonstration Project. This scan is helping members of NeuroDevNet's knowledge translation core plan and prioritize services and activities within NeuroDevNet.

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30. Semin Pediatr Neurol. 2011 Mar;18(1):21-5.

Evidence-based neuroethics for neurodevelopmental disorders.

Racine E, Bell E, Di Pietro NC, Wade L, Illes J.

Source: Neuroethics Research Unit, Institut de recherches cliniques de Montréal, Montreal, Quebec, Canada; Department of Medicine and Department of Social and Preventive Medicine, Université de Montréal, Montreal, Que-

bec, Canada; Department of Neurology and Neurosurgery, McGill University, Montreal, Quebec, Canada; Division of Experimental Medicine and Biomedical Ethics Unit, McGill University, Montreal, Quebec, Canada.

Many neurodevelopmental disorders affect early brain development in ways that are still poorly understood; yet, these disorders can place an enormous toll on patients, families, and society as a whole and affect all aspects of daily living for patients and their families. We describe a pragmatic, evidence-based framework for engaging in empiric ethics inquiry for a large consortium of researchers in neurodevelopmental disorders and provide relevant case studies of pragmatic neuroethics. The 3 neurodevelopmental disorders that are at the focus of our research, cerebral palsy (CP), autism spectrum disorder (ASD), and fetal alcohol spectrum disorder (FASD), bring unique and intersecting challenges of translating ethically research into clinical care for children and neonates. We identify and discuss challenges related to health care delivery in CP; neonatal neurological decision making; alternative therapies; and identity, integrity, and personhood.

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31. Dev Med Child Neurol. 2011 Jun;53(6):516-21. doi: 10.1111/j.1469-8749.2011.03932.x.

Function and neuroimaging in cerebral palsy: a population-based study.

Himmelman K, Uvebrant P.

Source: Department of Paediatrics, Institute of Clinical Sciences, Queen Silvia Children's Hospital, Sahlgrenska Academy at the University of Gothenburg, Gothenburg, Sweden.

Aim: The aim of this population-based study was to describe function in cerebral palsy (CP) in relation to neuroimaging. Method: Motor function, accompanying impairments, and neuroimaging (86 by magnetic resonance imaging, 74 by computed tomography) were studied in 186 children born in western Sweden between 1999 and 2002 (96 males, 90 females; age range at data collection 4-8y). Results: Forty per cent of the children had unilateral spastic CP, 39% bilateral, 16% dyskinetic CP, and 5% ataxia. Fifty-one per cent were in level I of the Gross Motor Function Classification System (GMFCS), 14% in level II, 3% in level III, 11% in level IV, and 22% level V. Forty per cent of the children were in level I of the Manual Ability Classification System 19% were in II, 9% at III, 8% in IV, and 24% in level V. Seventy-six per cent of the children with white-matter lesions were in GMFCS levels I and II, whereas 67% with basal ganglia lesions were in levels IV and V. Learning disability* (45%), epilepsy (44%), and visual impairment (17%) were most common in children with brain maldevelopment, and cortical/subcortical or basal ganglia lesions. Speech was impaired in 49% of the children, absent in 30%, and 6% had a neuropsychiatric diagnosis. Compared with children born between 1991 and 1998, the numbers of those in GMFCS level I increased ($p=0.007$), as did those with epilepsy ($p=0.015$). Interpretation: Neuroimaging improves the understanding of the neuroanatomical basis for function in CP. Type and severity of motor impairment and accompanying impairments are related to the timing of lesions.

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32. J Pediatr. 2011 May 16. [Epub ahead of print]

Impact of Delivery Room Resuscitation on Outcomes up to 18 Months in Very Low Birth Weight Infants.

Demauro SB, Roberts RS, Davis P, Alvaro R, Bairam A, Schmidt B; Caffeine for Apnea of Prematurity Trial Investigators.

Source: The Children's Hospital of Philadelphia and University of Pennsylvania, Philadelphia, PA.

OBJECTIVE: To examine the relationships between intensity of delivery room resuscitation and short- and long-term outcomes of very low birth weight infants enrolled in the Caffeine for Apnea of Prematurity (CAP) Trial. STUDY DESIGN: The CAP Trial enrolled 2006 infants with birthweights between 500 and 1250 g who were eligible for caffeine therapy. All levels of delivery room resuscitation were recorded in study participants. We divided infants in 4

groups of increasing intensity of resuscitation: minimal, n = 343; bag-mask ventilation, n = 372; endotracheal intubation, n = 1205; and cardiopulmonary resuscitation (chest compressions/epinephrine), n = 86. We used multivariable logistic regression models to compare outcomes across the 4 groups. RESULTS: The observed rates of death or disability, death, cerebral palsy, cognitive deficit, and hearing loss at 18 months increased with higher levels of resuscitation. Risk of bronchopulmonary dysplasia, severe retinopathy of prematurity, and brain injury also increased with higher levels of resuscitation. Adjustment for prognostic variables reduced the differences between the groups for most outcomes. Only the adjusted rates of bronchopulmonary dysplasia and severe retinopathy remained significantly higher after more intense resuscitation. CONCLUSIONS: In CAP Trial participants, the risk of death or neurodevelopmental disability at 18 months did not increase substantially with increasing intensity of delivery room resuscitation.

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33. Obstet Gynecol Clin North Am. 2011 Jun;38(2):351-66.

Antenatal exposure to magnesium sulfate and neuroprotection in preterm infants.

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Source: Division of Maternal Fetal Medicine, Department of Obstetrics and Gynecology, The University of Texas Medical Branch, 301 University Boulevard, Galveston, TX 77555-0587, USA.

Cerebral palsy is a leading cause of childhood neuromotor disability and is strongly associated with preterm delivery. Basic science research and some observational studies have suggested a neuroprotective benefit from antenatal exposure to magnesium sulfate. Recent randomized controlled studies and meta-analyses suggest that antenatal exposure to magnesium sulfate before anticipated preterm birth is associated with reduction in the risk of developing cerebral palsy or its associated neurologic disabilities in surviving infants. More importantly, this benefit has been achieved without increasing the risk of perinatal mortality.

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34. Pediatr Radiol. 2011 May 20. [Epub ahead of print]

Brain magnetic resonance findings in symptomatic congenital cytomegalovirus infection.

Manara R, Balao L, Baracchini C, Drigo P, D'Elia R, Ruga EM.

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BACKGROUND: Congenital cytomegalovirus (CMV) infection can lead to severe neurological sequelae, but a defined brain magnetic resonance (MR) pattern and MR predictors of clinical outcome are still lacking. MATERIALS AND METHODS: Clinical and MR findings of 14 children with symptomatic congenital CMV infection were retrospectively reviewed. RESULTS: Microcephaly, cerebral palsy and epilepsy were found in eight, six and seven patients, respectively (all concomitant in 6); 12 children developed sensory-neural hearing loss (SNHL). At first MRI (mean age 21 months, range 5-54 months), white matter (WM) involvement was not assessable in two children due to incomplete myelination. WM abnormalities were common (11/12 patients); deep WM was predominantly involved in 5/11; the largest WM lesion was in the parietal lobe in 6/11. Anterior temporal lobe abnormalities were found in 13/14. Six children underwent MRI examination after 2 years of life; in this subgroup, WM abnormalities were extensive and confluent (4/6), bilateral and multifocal (1/6) or absent (1/6). Four children showed a progression of myelination. Ventriculomegaly (9/14), migration disorders (6/14 polymicrogyria and 1/14 pachygyria-lissencephaly) and hippocampal dysplasia (6/14) correlated with severe neurological sequelae ($p < 0.05$, Fisher exact test), while the presence of WM abnormalities (11/12), periventricular cysts (6/14) and cerebellar hypoplasia (4/14) did not predict the outcome. CONCLUSIONS: The spectrum of brain MR abnormalities in symptomatic congenital CMV infection is

extremely wide. WM involvement is variable, difficult to evaluate at a very young age and unrelated to clinical outcome, while cortical malformations, ventriculomegaly and hippocampal dysplasia seem to be strong predictors of poor outcome except for SNHL.

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