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Interventions and Management

1. *Dev Med Child Neurol.* 2013 Nov;55 Suppl 4:43-6. doi: 10.1111/dmcn.12306.

Impaired motor planning and motor imagery in children with unilateral spastic cerebral palsy: challenges for the future of pediatric rehabilitation.

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Compromised action performance is one of the most characteristic features of children with unilateral spastic cerebral palsy (USCP). Current rehabilitation efforts predominantly aim to improve the capacity and performance of the affected arm. Recent evidence, however, suggests that compromised motor planning may also negatively affect performance of activities of daily living. In this paper we will first discuss the recent evidence for this motor planning deficit, followed by studies on motor imagery in this population. Motor imagery is an experimental approach in which the contents of the motor plan become overt. Converging evidence indicates a compromised motor imagery ability in USCP. As the neural structures of both motor planning and motor imagery overlap, rehabilitation by motor imagery training may alleviate motor problems in USCP. Increasing evidence for this approach exists in older adults with stroke. We conclude this review with recommendations on such a training approach for children with USCP.

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2. *Dev Med Child Neurol.* 2013 Oct 8. doi: 10.1111/dmcn.12273. [Epub ahead of print]

Guidelines for future research in constraint-induced movement therapy for children with unilateral cerebral palsy: an expert consensus.

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AIM: The aim of this study was to provide an overview of what is known about constraint-induced movement

therapy (CIMT) in children with unilateral cerebral palsy (CP), to identify current knowledge gaps, and to provide suggestions for future research. **METHOD:** Nine experts participated in a consensus meeting. A comprehensive literature search was conducted and data were summarized before the meeting. The core model produced by the European network for Health Technology Assessment was used as a framework for discussion and to identify critical issues for future research. **RESULTS:** All models of CIMT have demonstrated improvements in the upper limb abilities of children with unilateral CP. A consensus was reached on 11 important questions to be further explored in future studies. The areas of highest priority included the effect of dosage, the effect of repeated CIMT, and the impact of predictive factors, such as age, on the response to CIMT. Consensus suggestions for future study designs and the use of validated outcome measures were also provided. **INTERPRETATION:** The CIMT construct is complex, and much remains unknown. It is unclear whether a specific model of CIMT demonstrates superiority over others and whether dosage of training matters. Future research should build upon existing knowledge and aim to provide information that will help implement CIMT in various countries with different health care resources and organizational structures.

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3. Dev Med Child Neurol. 2013 Nov;55 Suppl 4:38-42. doi: 10.1111/dmcn.12305.

Upper limb activity in children with unilateral spastic cerebral palsy: the role of vision in movement strategies.

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This article reviews the capacity of children with unilateral spastic cerebral palsy (USCP) to (re)organize the available degrees of freedom and to use visual information in interceptive actions during motion with either the impaired or the less-impaired hand. Atypical reaching movements, such as increased trunk movement or slower wrist velocity, are considered adaptive coordination patterns that are the result of a change in the constraints. It is argued that manipulation of the task context facilitates children with USCP to enhance performance. For example, when reducing the time available to intercept a ball, the children are found to exceed their usual maximum walking speed and to increase range of motion of the elbow. In addition, the children appear to rely on a visual information strategy similar to typically developing children ('bearing angle'), although more variability is observed when using the impaired arm. The implications for interventions are, it should be recognized, that these children adapt to the impairment by reorganizing the movement system and that this process can be influenced by changing the task context. Attention should be paid to the importance of using correct visual cues for initiation and guidance of interceptive actions, which may be provoked by using external visual triggers.

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4. Dev Med Child Neurol. 2013 Nov;55 Suppl 4:32-7. doi: 10.1111/dmcn.12304.

Pathophysiology of impaired hand function in children with unilateral cerebral palsy.

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Unilateral spastic cerebral palsy, caused by damage to the developing central nervous system, is characterized by motor impairments mainly lateralized to one side of the body, with hand impairments greatly contributing to functional limitations. The integrity of the motor areas and the corticospinal tract (CST) is often compromised. The specific etiology may drastically influence subsequent development of CST pathways. Here we describe the

pathophysiology underlying impaired upper extremity function, with particular emphasis on the relation between CST damage and hand function. We also describe the resulting sensory and motor deficits, with an emphasis on studies of precision grip, which highlight impairments in motor execution, sensorimotor integration, motor planning, and bimanual coordination beyond dexterity impairments. We show that the type and extent of early brain damage and/or CST reorganization is highly predictive of the severity of these impairments. We discuss the clinical implications of these findings, including the intriguing possibility that the specific pathophysiology is predictive of treatment outcomes. We suggest that a 'one-treatment fits all approach' may be insufficient, and that future rehabilitation efforts will be best guided by closely relating treatment efficacy with the specific pathophysiology.

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5. J Exerc Rehabil. 2013 Aug 31;9(4):420-425.

Finger exercise with keyboard playing in adults with cerebral palsy: A preliminary study.

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Department of Music Therapy Education, Graduate School of Education and Ewha Music Rehabilitation Center, Ewha Womans University, Seoul, Korea.

The purpose of this study is to examine the effects of Therapeutic Instrument Music Performance (TIMP) for fine motor exercises in adults with cerebral palsy (CP). Individuals with CP (n = 5) received a total of twelve, 30-min TIMP sessions, two days per week for six to nine weeks. Pre- and post-Music Instrument Digital Interface (MIDI) data were used as a measure of hand function. Pre-velocity was significantly different from the normative data obtained from typical adults (n = 20); however, post-velocity did not yield significance, specifically in the second and fifth fingers, indicating improvement in hand function for the adults with cerebral palsy. The finding implies that TIMP using keyboard playing may effectively improve manual dexterity and velocity of finger movement. Based on these results, future program development of instrumental playing for adults with CP is called for to enhance both their independent living skills and quality of life.

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6. J Hand Surg Am. 2013 Dec;38(12):2432-6. doi: 10.1016/j.jhsa.2013.09.028.

Long-term results following surgical treatment of elbow deformity in patients with cerebral palsy.

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PURPOSE: To evaluate the long-term results of surgical intervention for elbow flexion deformity in cerebral palsy. We hypothesized that improvements in elbow extension and flexion posture angle at ambulation would be maintained over time with preservation of active flexion. **METHODS:** A total of 23 patients (23 elbows) were available for long-term follow-up. Patients had fixed elbow contractures less than 45° and were treated with partial elbow muscle lengthening. Active and passive range of motion and elbow flexion posture during ambulation were measured at each follow-up, and longitudinal results were compared. **RESULTS:** Active extension and flexion posture angle during ambulation improved 12° and 63°, respectively, with an 8° loss of active flexion. **CONCLUSIONS:** Soft tissue lengthening of the anterior elbow can provide statistically significant lasting improvements in active extension and flexion posture during ambulation in patients with cerebral palsy. Our long-term findings substantiate previously reported short-term results.

TYPE OF STUDY/LEVEL OF EVIDENCE: Therapeutic IV.

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7. J Exerc Rehabil. 2013 Jun 30;9(3):368-374.**Relationships between lower limb muscle architecture and activities and participation of children with cerebral palsy.**

Ko IH, Kim JH, Lee BH.

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The purpose of this study was to determine the effects of the structure of skeletal muscle of lower extremities on function, activity, and participation of children with cerebral palsy. The subjects were 38 hospitalized patients and 13 infants with normal development. The following clinical measures were used for assessment of activity daily living and functional level of gross motor: Gross Motor Function Classification System (GMFCS), Gross Motor Function Measure (GMFM), Wee Functional Independence Measure (WeeFIM), International Classification of Functioning Child and Youth (ICF CY). Muscle thickness and strength of knee extensor and ankle extensor were collected using ultrasonography and manual muscle tester. Following the results of ICF CY evaluation for body function, activity, learning and application of knowledge, communication and environmental factors showed a decline ($P < 0.05$). Significant differences in the thickness of muscle was observed according to the GMFCS level, thickness of knee extensor and ankle extensor of cerebral palsy ($P < 0.05$), and clauses of self-care, activity, mobility, ambulation, communication, and social acknowledgement ($P < 0.05$). Following analysis, results showed negative correlation in the thickness of muscle, muscle strength, major motor function, daily activity and participation; the score of ICF-CY was shown to decline due to the high score for differences in thickness of muscle, muscle strength, WeeFIM, and GMFM. The thickness and muscle strength of lower extremities affect main functions of the body and improvement of muscle strength of lower extremities may have positive effects on social standards such as activity and participation of cerebral palsy.

[PMID: 24278886](#) [PubMed - as supplied by publisher]**8. Exp Brain Res. 2013 Nov 23. [Epub ahead of print]****Pointing with the ankle: the speed-accuracy trade-off.**

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This study investigated the trade-off between speed and accuracy in pointing movements with the ankle during goal-directed movements in dorsal-plantar (DP) and inversion-eversion (IE). Nine subjects completed a series of discrete pointing movements with the ankle between spatial targets of varying difficulty. Six different target sets were presented, with a range of task difficulty between 2.2 and 3.8 bits of information. Our results demonstrated that for visually evoked, visually guided discrete DP and IE ankle pointing movements, performance can be described by a linear function, as predicted by Fitts' law. These results support our ongoing effort to develop an adaptive algorithm employing the speed-accuracy trade-off concept to control our pediatric anklebot while delivering therapy for children with cerebral palsy.

[PMID: 24271402](#) [PubMed - as supplied by publisher]**9. Gait Posture. 2013 Oct 27. pii: S0966-6362(13)00650-4. doi: 10.1016/j.gaitpost.2013.10.016. [Epub ahead of print]****Femoral derotational osteotomy: Surgical indications and outcomes in children with cerebral palsy.**

Schwartz MH, Rozumalski A, Novacheck TF.

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Excessive femoral anteversion is common among children with cerebral palsy, and is, frequently treated by a femoral derotational osteotomy (FDO). It is important to understand surgical indications for FDO, and the impact of these indications on the treatment outcomes. The Random Forest algorithm was used to objectively identify historical surgical indications in a large retrospective, cohort of 1088 limbs that had previously undergone single-event multi-level surgery. Treatment, outcome was based on transverse plane kinematics obtained from three-dimensional gait analysis. The classifier effectively identified the historic indications (accuracy=.85, sensitivity=.93, specificity=.69, positive predictive value=.86, negative predictive value=.82), and naturally divided limbs into four clusters: two homogeneous +FDO clusters (with/without significant internal hip rotation during gait), one homogeneous -FDO cluster, and a mixed cluster. Concomitant surgeries were similar among the clusters. Limbs with excessive anteversion and internal hip rotation during gait had excellent outcomes, in the transverse plane. Limbs with excessive anteversion but only mild internal hip rotation had good outcomes at the hip level; but a significant number of these limbs ended up with an excessive external foot progression angle. The Random Forest algorithm was highly effective for identifying and organizing historic surgical indications. The derived criteria can be used to give surgical decision making, guidance in a majority of limbs. The results suggest that limbs with anteversion and significant, internal hip rotation during gait benefit from an FDO, but limbs with excessive anteversion and only, mild internal hip rotation are at risk of developing an excessive external foot progression angle.

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10. J Pediatr Orthop. 2013 Nov 21. [Epub ahead of print]

Can Turned Inward Patella Predict an Excess of Femoral Anteversion During Gait in Spastic Diplegic Children?

Simon AL Jr, Presedo A, Ilharreborde B, Mallet C, Mazda K, Penneçot GF.

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BACKGROUND: Determining patellar orientation in the transverse plane during observational gait analysis is a fundamental aspect of physical examinations. Many physicians consider that an abnormal position of the patella in the transverse planes is only explained by a rotational abnormality of the proximal femur.

METHODS: A total of 188 spastic diplegic children with cerebral palsy were reviewed (376 lower limbs). The physical examination included observation of patellar orientation at midstride and measuring femoral anteversion (FA). All patients also underwent 3-dimensional (3D) computerized gait analysis of pelvic and hip rotation kinematics.

RESULTS: Observational gait analysis and videotapes found 103 children (206 lower limbs) with inturned patella at midstance. Kinematic data from 3D gait analysis showed that the visual impression of turned inward patella was erroneous in 48 limbs. Of the remaining 158 lower limbs, 117 (74%) exhibited excessive FA and 41 (26%) did not. Of the 117 with excessive FA, kinematics showed only 66 (56%) with excessive internal hip rotation (with or without excessive internal pelvic rotation). Of the 41 lower limbs without excessive FA, 25 were explained by excessive internal pelvic rotation and 16 were explained by excessive internal hip rotation (isolated spasticity and/or contracture of internal rotator muscles). Turned inward patella was caused by isolated excessive internal pelvic rotation in 48%, excessive internal hip rotation in 35% (including 44 cases with excessive FA and 12 cases with isolated spasticity and/or contracture of internal hip rotators), and excessive internal hip rotation combined with excessive internal pelvic rotation in 17%.

CONCLUSIONS: Excessive FA was not the only cause of turned inward patella gait and could not explain this gait anomaly by itself. Excessive internal pelvic rotation was the most frequent cause of turned inward patella gait.

LEVEL OF EVIDENCE: Level IV.

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11. J Pediatr Orthop. 2013 Nov 21. [Epub ahead of print]**The Quality of Pediatric Orthopaedic Information on the Internet.**

Winship B, Grisell M, Yang CB, Chen RX, Bauer AS.

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BACKGROUND: Many patients use the Internet for health information. However, there are few guarantees to the reliability and accuracy of this information. This study examined the quality and content of the Internet Web pages for 10 common pediatric orthopaedic diagnoses. **METHODS:** We identified 10 common diagnoses in pediatric orthopaedics: brachial plexus injury, cerebral palsy, clubfoot, developmental dysplasia of the hip, leg length discrepancy, osteochondroma, polydactyly, scoliosis, spina bifida, and syndactyly. We used 2 of the most popular search engines to identify the top 10 Web sites for each disease. We evaluated the Web sites utilizing both the quality-based Health On the Net (HON) Foundation criteria and our own content-based grading sheets. The custom grading sheets focused on essential information about disease summary, pathogenesis, diagnosis, treatment, and prognosis. **RESULTS:** Three orthopaedic surgeons graded 98 academic, commercial, nonprofit, and physicians' Web sites for 10 diseases. Academic Web sites scored the highest in content (mean, 60.8%±15.5%), whereas commercial Web sites scored the lowest (mean, 46.7%±22.2%). Among the diagnoses, osteochondroma Web sites had the highest content scores (mean, 75.8%±11.8%), whereas polydactyly Web sites had the lowest content scores (mean, 39.3%±15.7%). In contrast, Web sites about developmental dysplasia of the hip had the highest HON scores (65.0±11.1), whereas those about brachial plexus birth palsy scored the lowest (42.6%±16.9%). Among the content subgroups, scores were generally higher for disease summary and diagnostics and lower for prognosis. **CONCLUSIONS:** The Internet Web sites reviewed demonstrated a wide range of content and information. We found that nonprofit and academic Web sites were the most reliable sources, whereas commercial and, surprisingly, physician-run Web sites were the least reliable. We advise physicians to talk to their patients about the information they get on the Internet and how it dictates their expectations. We hope this study, combined with further understanding of how our patients use this information, can help improve the Internet content. **CLINICAL RELEVANCE:** Physicians should know that their patients may be receiving misleading information from the Internet and be able to discuss this with their patients.

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12. Dev Med Child Neurol. 2013 Nov;55 Suppl 4:47-54. doi: 10.1111/dmcr.12307.**Does goal setting in activity-focused interventions for children with cerebral palsy influence treatment outcome?**

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Today, treatment for children with cerebral palsy predominantly aims at improving the children's possibilities to perform everyday activities in their natural environment. The activities in focus for intervention are often expressed as specific goals, frequently defined in a collaborative goal-setting process between professionals and parents. The role of goal setting to improve the outcome of the intervention has not been shown in the literature so far. Thus, the aim of this systematic review was to explore if goal setting has an impact on treatment outcome assessed by standardized measures. CINAHL and MEDLINE were searched from January 2000 to October 2012, resulting in a final selection of 13 articles, six of which were randomized controlled trials. Methodological quality was assessed and study characteristics were analysed descriptively. Subject characteristics, type of intervention/s, frequency, and intensity of therapy varied largely. Outcome was assessed by standardized outcome measures as well as evaluated through aspects of goal attainment. Most studies showed robust within-group changes according to study-appropriate standardized measures, whereas the between-group comparisons exhibited less consistent differences in outcome. The review does not provide support for a positive effect of goal setting per se on treatment outcome. Studies that specifically measure the effect of goal setting on treatment outcome are needed.

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13. Sleep Med. 2013 Oct 31. pii: S1389-9457(13)01178-7. doi: 10.1016/j.sleep.2013.07.022. [Epub ahead of print]

Diffusion tensor imaging in a patient with cerebral palsy and hypersomnia.

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[PMID: 24269132](#) [PubMed - as supplied by publisher]

14. World J Gastroenterol. 2013 Nov 21;19(43):7696-700. doi: 10.3748/wjg.v19.i43.7696.

Laparoscopy-assisted percutaneous endoscopic gastrostomy enables enteral nutrition even in patients with distorted anatomy.

Hermanowicz A, Matuszczak E, Komarowska M, Jarocka-Cyrta E, Wojnar J, Debek W, Matysiak K, Klek S.

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AIM: To analyze whether laparoscopy-assisted percutaneous endoscopic gastrostomy (PEG) could be a valuable option for patients with complicated anatomy. METHODS: A retrospective analysis of twelve patients (seven females, five males; six children, six young adults; mean age 19.2 years) with cerebral palsy, spastic quadriplegia, severe kyphoscoliosis and interposed organs and who required enteral nutrition (EN) due to starvation was performed. For all patients, standard PEG placement was impossible due to distorted anatomy. All the patients qualified for the laparoscopy-assisted PEG procedure. RESULTS: In all twelve patients, the laparoscopy-assisted PEG was successful, and EN was introduced four to six hours after the PEG placement. There were no complications in the perioperative period, either technical or metabolic. All the patients were discharged from the hospital and were then effectively fed using bolus methods. CONCLUSION: Laparoscopy-assisted PEG should become the method of choice for gastrostomy tube placement and subsequent EN if PEG placement cannot be performed safely.

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15. Clin Pediatr (Phila). 2013 Nov 25. [Epub ahead of print]

Adolescents With Cerebral Palsy: Transitioning to Adult Health Care Services.

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Data from the 2009-2010 US National Survey of Children with Special Health Care Needs were examined to determine the health, developmental and behavioral status of adolescents with cerebral palsy (CP) and to assess how well pediatric health care providers were preparing them for transition to adult health care services. Adolescents with CP had no higher rates of attention deficit hyperactivity disorder, depression, anxiety, oppositional or conduct disorders, or autism spectrum than a comparison group. However, those with CP participated less in sports, clubs, or other organized activities ($P < .001$). Neither group reported much help in coordinating health services or preparing for transition to adult health care services. Inadequate adult health care services have a direct and unsatisfactory impact on the adult life span. Physicians and other health care providers who include adolescents with CP in their practices should begin discussion and planning for transition to adult health care early.

in adolescence.

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16. Eur J Phys Rehabil Med. 2013 Nov 28. [Epub ahead of print]

The effect of having a children with cerebral palsy on quality of life, burn-out, depression and anxiety scores: a comparative study.

Basaran A, Karadavut KI, Uneri SO, Balbaloglu O, Atasoy N.

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Background: The caregivers of children with cerebral palsy (CP) should overcome the difficulties and complications arising from their children's impairments. It may be stressful for the caregivers when the balance between these inevitable demands and their own social needs impairs. Therefore, the primary caregiver, may experience several psycho-social problems. **Aim:** To compare the quality of life (QoL), mental health and burnout of caregivers of patients with CP and healthy controls. The effects of the functional limitations of children with CP on the QoL, mental health and burnout of caregivers have also been evaluated. **Design:** Cross-sectional, comparative. **Setting:** Outpatient. **Population:** One hundred and forty-three caregivers of children with CP and 60 caregivers of typically developing children were recruited for the study. **Materials and methods:** The inventories related to QoL, mental health and burnout of the caregivers for both groups were compared. The correlations between functional limitations of the children with CP and QoL, mental health and burnout of their caregivers have been analyzed. **Results:** Caregivers in CP group had poorer QoL, worse mental health, and higher burnout levels compared to the controls. The functional limitations of the children with CP were correlated with impairment of QoL and depression scores of their caregivers, but not with the anxiety or burnout scores. **Conclusion:** Having a disabled child has interference on caregivers' QoL and mental health and increases the burnout. Furthermore, as the functional impairment level of the child increases, the interference does too. **Clinical rehabilitation impact:** Health professionals working in this area should also consider the mental health and the QoL of caregivers and should develop interventions that support and nurture the family as a whole.

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Prevention and Cure

17. Lancet. 2013 Nov 19. pii: S0140-6736(13)61835-8. doi: 10.1016/S0140-6736(13)61835-8. [Epub ahead of print]

Cerebral palsy.

Colver A, Fairhurst C, Pharoah PO.

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The syndrome of cerebral palsy encompasses a large group of childhood movement and posture disorders. Severity, patterns of motor involvement, and associated impairments such as those of communication, intellectual ability, and epilepsy vary widely. Overall prevalence has remained stable in the past 40 years at 2-3-5 cases per 1000 livebirths, despite changes in antenatal and perinatal care. The few studies available from developing countries suggest prevalence of comparable magnitude. Cerebral palsy is a lifelong disorder; approaches to intervention, whether at an individual or environmental level, should recognise that quality of life and social participation throughout life are what individuals with cerebral palsy seek, not improved physical function for its own sake. In the past few years, the cerebral palsy community has learned that the evidence of benefit for the numerous drugs, surgery, and therapies used over previous decades is weak. Improved understanding of the role of multiple gestation in pathogenesis, of gene environment interaction, and how to influence brain plasticity could yield

significant advances in treatment of the disorder. Reduction in the prevalence of post-neonatal cerebral palsy, especially in developing countries, should be possible through improved nutrition, infection control, and accident prevention.

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18. Neurology. 2013 Nov 27. [Epub ahead of print]

Prevalence of ataxia in children: A systematic review.

Musselman KE, Stoyanov CT, Marasigan R, Jenkins ME, Konczak J, Morton SM, Bastian AJ.

From the Department of Neuroscience (K.E.M., A.J.B.), Johns Hopkins School of Medicine, Baltimore, MD; Kennedy Krieger Institute (K.E.M., R.M., A.J.B.), Baltimore, MD; Johns Hopkins Bloomberg School of Public Health (C.T.S.), Baltimore, MD; Department of Clinical Neurological Sciences (M.E.J.), Western University, London, Ontario, Canada; School of Kinesiology (J.K.), University of Minnesota, Minneapolis; and Department of Physical Therapy (S.M.M.), University of Delaware, Newark.

OBJECTIVE: To estimate the prevalence of childhood ataxia resulting from both genetic and acquired causes. **METHODS:** A systematic review was conducted following the PRISMA (Preferred Reporting Items for Systematic Reviews and Meta-analyses) statement. Five databases were searched for articles reporting a frequency measure (e.g., prevalence, incidence) of ataxia in children. Included articles were first grouped according to the World Health Organization (WHO) regions and subsequently classified according to etiology (genetic, acquired, or mixed). Each article was assessed for its risk of bias on the domains of sampling, measurement, and analysis. Incidence values were converted to prevalence estimates whenever possible. European prevalence estimates for different etiologies of ataxia were summed to gauge the overall prevalence of childhood ataxia. **RESULTS:** One hundred fifteen articles were included in the review. More than 50% of the data originated from the Europe WHO region. Data from this region also showed the least susceptibility to bias. Little data were available for Africa and Southeast Asia. The prevalence of acquired ataxias was found to vary more greatly across regions than the genetic ataxias. Ataxic cerebral palsy was found to be a significant contributor to the overall prevalence of childhood ataxia across WHO regions. The prevalence of childhood ataxias in Europe was estimated to be ~26/100,000 children and likely reflects a minimum prevalence worldwide. **CONCLUSIONS:** The findings show that ataxia is a common childhood motor disorder with a higher prevalence than previously assumed. More research concerning the epidemiology, assessment, and treatment of childhood ataxia is warranted.

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19. Dev Med Child Neurol. 2013 Nov;55 Suppl 4:27-31. doi: 10.1111/dmcn.12303.

Pathophysiological mechanisms of impaired limb use and repair strategies for motor systems after unilateral injury of the developing brain.

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The corticospinal tract (CST) is important for limb control. In humans, it begins developing prenatally but CST connections do not have a mature pattern until about 6 months of age and its capacity to evoke muscle contraction does not mature until mid-adolescence. An initially bilateral projection is subsequently refined, so that most ipsilateral CST connections are eliminated. Unilateral brain damage during refinement leads to bilateral developmental impairments. The damaged side develops sparse and weak contralateral spinal connections and the non-involved hemisphere maintains its ipsilateral projection to develop an aberrant bilateral spinal projection. In a kitten model of unilateral spastic cerebral palsy, we replicate key features of the CST circuit changes: robust bilateral CST projections from the non-involved hemisphere, sparse contralateral connections from the affected

hemisphere, and motor impairments. We discuss the role of activity-dependent synaptic competition in development of bilateral CSTs and consider several experimental strategies for restoring a more normal pattern of CST connections from the damaged and non-involved sides. We highlight recent results stressing the importance of combined repair of CST axons, restoration of a more normal motor cortex motor representation, and key involvement of spinal cholinergic interneurons in restoring skilled motor function.

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20. Dev Med Child Neurol. 2013 Nov;55 Suppl 4:1-4. doi: 10.1111/dmnc.12297.

Development of fine motor skills in preterm infants.

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Fine motor skills are related to functioning in daily life and at school. We reviewed the status of knowledge, in preterm children, on the development of fine motor skills, the relation with gross motor skills, and risk factors for impaired fine motor skills. We searched the past 15 years in PubMed, using ['motor skills' or 'fine motor function' and 'preterm infant'] as the search string. Impaired gross and fine motor skills are among the most frequently occurring problems encountered by preterm children who do not develop cerebral palsy. The prevalence is around 40% for mild to moderate impairment and 20% for moderate impairment. Fine motor skill scores on the Movement Assessment Battery for Children are about 0.62 of a standard deviation lower compared with term children. Risk factors for fine motor impairments include moderately preterm birth (odds ratio [OR] 2.0) and, among very preterm children (<32wk gestation), intra-uterine growth restriction (ORs 2-3), inflammatory conditions (late-onset sepsis and necrotizing enterocolitis, ORs 3-5), and dexamethasone therapy for bronchopulmonary dysplasia (OR 2.7). A better understanding of factors that play a role in the development of and recovery from brain injury could guide future intervention attempts aimed at improving fine motor skills of preterm children.

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