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Interventions and Management

1. Common Etiologies of Upper Extremity Spasticity.

Angulo-Parker FJ, Adkinson JM.

Hand Clin. 2018 Nov;34(4):437-443. doi: 10.1016/j.hcl.2018.06.001. Epub 2018 Aug 18.

Spasticity is a motor disorder that manifests as a component of the upper motor neuron syndrome. It is associated with paralysis and can cause significant disability. The most common causes leading to spasticity include stroke, traumatic brain injury, multiple sclerosis, spinal cord injury, and cerebral palsy. This article discusses the pathophysiology and clinical findings associated with each of the most common etiologies of upper extremity spasticity.

PMID: [30286958](#)

2. Considerations in the Management of Upper Extremity Spasticity.

Gart MS, Adkinson JM.

Hand Clin. 2018 Nov;34(4):465-471. doi: 10.1016/j.hcl.2018.06.004. Epub 2018 Aug 18.

Spasticity is a movement disorder characterized by a velocity-dependent increase in muscle tone and a hyperexcitable stretch reflex. Common causes of spasticity include cerebral palsy, spinal cord injury, and stroke. Surgical treatment plans for spasticity must be highly individualized and based on the characteristics of patients and the spasticity in order to maximize functional gains. Candidates for surgery must be carefully selected. In this article, the authors review the pathophysiology of spasticity and discuss general considerations for surgical management with an emphasis on patient factors and spasticity characteristics. Specific considerations for the common causes of spasticity are presented.

PMID: [30286961](#)

3. Surgical Management of Spasticity of the Thumb and Fingers.

Waljee JF, Chung KC.

Hand Clin. 2018 Nov;34(4):473-485. doi: 10.1016/j.hcl.2018.06.005.

Spasticity of the hand profoundly limits an individual's independent ability to accomplish self-care and activities of daily living. Surgical procedures should be tailored to patients' needs and functional ability, and even patients with severe cognitive

injuries and poor upper extremity function may benefit from surgery to improve appearance and hygiene. Careful preoperative examination and planning are needed, and consideration is given to the potential unintended detrimental effect of a surgical procedure on hand function.

PMID: [30286962](#)

4. Surgical Management of Spasticity of the Forearm and Wrist.

Duquette SP, Adkinson JM.

Hand Clin. 2018 Nov;34(4):487-502. doi: 10.1016/j.hcl.2018.06.006.

Upper extremity spasticity may result from a variety of types of brain injury, including cerebral palsy, stroke, or traumatic brain injury. These conditions lead to a predictable pattern of forearm and wrist deformities caused by opposing spasticity and flaccid paralysis. Upper extremity spasticity affects all ages and sociodemographics and is a complex clinical problem with a variety of treatment options depending on the patient, the underlying disease process, and postoperative expectations. This article discusses the cause, diagnosis, operative planning, operative techniques, postoperative outcomes, and rehabilitation protocols for the spastic wrist and forearm.

PMID: [30286963](#)

5. Technical Pearls of Tendon Transfers for Upper Extremity Spasticity.

Trehan SK, Little KJ.

Hand Clin. 2018 Nov;34(4):529-536. doi: 10.1016/j.hcl.2018.06.009.

Tendon transfers are an important surgical option when treating patients with muscular imbalance due to upper extremity spasticity. A successful surgical outcome requires a thorough preoperative clinical evaluation, an understanding of tendon transfer biomechanics, appropriate donor and recipient muscle selection, technical execution, and postoperative rehabilitation. This article reviews the principles, biomechanics, and techniques for commonly performed tendon transfers in patients with upper extremity spasticity.

PMID: [30286967](#)

6. Management of Joint Contractures in the Spastic Upper Extremity.

Wood KS, Daluiski A.

Hand Clin. 2018 Nov;34(4):517-528. doi: 10.1016/j.hcl.2018.06.011.

Upper extremity contractures in the spastic patient may result from muscle spasticity, secondary muscle contracture, or joint contracture. Knowledge of the underlying cause is critical in planning successful treatment. Initial management consists of physical therapy and splinting. Botulinum toxin can be helpful, as a therapeutic treatment in relieving spasticity and as a diagnostic tool in determining the underlying cause of the contracture. Surgical management options include release or lengthening of the causative muscle/tendon unit and joint capsular release, as required. Postoperative splinting is important to maintain the improved range of motion and protect any associated tendon lengthening or transfer.

PMID: [30286966](#)

7. Surgical Management of Spasticity of the Shoulder.

Zlotolow DA.

Hand Clin. 2018 Nov;34(4):511-516. doi: 10.1016/j.hcl.2018.06.008. Epub 2018 Aug 18.

Although spastic conditions often involve the shoulder, it is rare for surgical intervention to be required. In cases in which chemodenervation and therapy are insufficient to optimize the patient's function or minimize their care requirements, surgical options, such as tendon and joint releases, can be considered. Tendon transfers are rarely indicated. Nerve transfers, particularly contralateral C7, may play a larger role in the future as we gain further understanding into the risks, indications, and contraindications of this exciting technique.

PMID: [30286965](#)

8. Outcomes After Surgical Treatment of Spastic Upper Extremity Conditions.

Tranchida GV, Van Heest AE.

Hand Clin. 2018 Nov;34(4):583-591. doi: 10.1016/j.hcl.2018.06.014. Epub 2018 Aug 20.

Surgical interventions for the spastic upper extremity aim to correct the common deformities of elbow flexion, forearm pronation, wrist flexion and ulnar deviation, and thumb-in-palm deformity. One goal is achieving optimal function and improved limb positioning. Aesthetics of the limb have a profound impact on self-esteem and satisfaction. Surgical deformity correction has not reliably been shown to improve sensory function such as stereognosis. Validated outcome measures are used to present outcomes after surgical treatment of the spastic upper extremity as it relates to motor function and limb positioning, sensory function, and self-esteem.

PMID: [30286972](#)

9. Rehabilitation Strategies Following Surgical Treatment of Upper Extremity Spasticity.

Petuchowski J, Kieras K, Stein K.

Hand Clin. 2018 Nov;34(4):567-582. doi: 10.1016/j.hcl.2018.06.013. Epub 2018 Aug 20.

Upper motor neuron injuries that occur in cases such as cerebral palsy, cerebrovascular accidents, and traumatic brain injury often have resulting upper extremity deformity and dysfunction. Multiple surgical options are available to improve upper extremity positioning, and, in some cases, motor control. Postoperative therapeutic management is imperative to assist the patient/caregiver in maximizing potential functional gains. This article provides an overview of postoperative guidelines for commonly performed surgeries to manage upper extremity dysfunction caused by spasticity and discusses acute management as well as therapeutic techniques for functional training and improved motor control.

PMID: [30286971](#)

10. New Treatment Approaches on the Horizon for Spastic Hemiparesis.

Mayer NH.

PM R. 2018 Sep;10(9S2):S144-S150. doi: 10.1016/j.pmrj.2018.07.006.

This article presents 2 recent articles that propose novel interventions for treating spastic hemiparesis by changing biological infrastructure. In 18 patients with unilateral spastic arm paralysis due to chronic cerebral injury greater than 5 years' duration, Zheng et al transferred the C7 nerve from the nonparalyzed side to the side of the arm that was paralyzed. Over a follow-up period of 12 months, they found greater improvement in function and a reduction of spasticity compared to rehabilitation alone. Using functional magnetic resonance imaging, they also found evidence for physiological connectivity between the ipsilateral cerebral hemisphere and the paralyzed hand. In the second article, Raghavan et al examine the concept of stiffness, a common symptom in patients with spastic hemiparesis, as a physical change in the infrastructure of muscle. Raghavan's non-neural hyaluronan hypothesis postulates that an accumulation of hyaluronan within spastic muscles promotes the development of muscle stiffness in patients with an upper motor neuron syndrome (UMNS). In a case series of 20 patients with spastic hemiparesis, Raghavan et al report that upper limb intramuscular injections of hyaluronidase increased passive and active joint movement and reduced muscle stiffness. Interventions that change biological infrastructure in UMNS is a paradigm on the horizon that bears watching.

PMID: [30269800](#)

11. Nonsurgical Treatment Options for Upper Limb Spasticity.

Black L, Gaebler-Spira D.

Hand Clin. 2018 Nov;34(4):455-464. doi: 10.1016/j.hcl.2018.06.003. Epub 2018 Aug 18.

There are many nonsurgical treatment options for patients with upper limb spasticity. This article presents an algorithmic approach to management, encompassing evidence-based rehabilitation therapies, medications, and promising new orthotic and robotic innovations.

PMID: [30286960](#)**12. The Effects of Constraint-Induced Movement Therapy on Functions of Cerebral Palsy Children.**

Jamali AR, Amini M.

Iran J Child Neurol. 2018 Fall;12(4):16-27.

OBJECTIVES: Constraint-Induced Movement Therapy (CIMT) is an intervention method that can enhance cerebral palsy (CP) children's hand function. CP is a pervasive and common disorder which affects many aspects of a child life. Hemiplegic CP affects one side of a child's hand and has great effect on child's independence. We investigated the CIMT's studies conducted in Iran, and indicated the effectiveness of CIMT on duration and children age? **MATERIALS & METHODS:** This systematic review was conducted using the electronic databases such as Medline PubMed, CINAHL, etc. performed from 1990 to 2016. Iranian and foreigner famous journals in the fields of pediatrics such as Iranian Journal of Pediatrics (IJP), Iranian Rehabilitation Journal (IRJ) and Google scholar with some specific keywords such as CP, CIMT, and occupational therapy were searched. **RESULTS:** Overall, 43 articles were found, from which, 28 articles were removed because of lack of relevancy. Ten article were omitted because of duplication and exclusion criteria, so finally 15 articles were included. **CONCLUSION:** CIMT is effective compared to no intervention but there are some inconsistencies regarding some parts of CIMT effectiveness such as its effectiveness on muscle tone and protective extension.

PMID: [30279705](#)**13. Intervention-Induced Motor Cortex Plasticity in Hemiparetic Children With Perinatal Stroke.**

Kuo HC, Zewdie E, Ciechanski P, Damji O, Kirton A.

Neurorehabil Neural Repair. 2018 Oct 4;1545968318801546. doi: 10.1177/1545968318801546. [Epub ahead of print]

BACKGROUND: Clinical trials are suggesting efficacy of intensive therapy combined with brain stimulation to improve hand function in hemiparetic children with perinatal stroke. However, individual variability exists and the underlying neuroplasticity mechanisms are unknown. Exploring primary motor cortex (M1) neurophysiology, and how it changes with such interventions, may provide valuable biomarkers for advancing personalized neurorehabilitation. **METHODS:** Forty-five children (age 6-19 years) with hemiparesis participated in PLASTIC CHAMPS, a blinded, sham-controlled, factorial clinical trial. All received 80 hours of goal-directed intensive upper extremity therapy. They were randomized into 4 groups: repetitive transcranial magnetic stimulation (rTMS) of contralesional M1, constraint therapy, both, or neither. Stimulus recruitment curves (SRC), short-interval intracortical inhibition (SICI), and intracortical facilitation (ICF) for lesioned and contralesional M1 were investigated using TMS. Clinical assessments including the Assisting Hand Assessment (AHA) and Canadian Occupational Performance Measure (COPM) were conducted pre- and postintervention. **RESULTS:** All children completed the intervention and both function (AHA) and goal performance (COPM) improved with additive effects of rTMS and constraint ($P < .01$). After intervention, motor-evoked potential (MEP) amplitudes from the contralesional M1 to the less-affected hand increased ($n = 16$, $P < .02$). SRC from the contralesional M1 to the less-affected hand increased ($n = 25$, $P < .01$). SICI of the contralesional M1 to the less-affected hand decreased ($n = 30$, $P < .04$). No changes were observed for ICF in either hemisphere ($P > .12$). **CONCLUSION:** TMS applied before/after intensive neuromodulation therapies can explore M1 neurophysiology and plasticity in children with cerebral palsy. Increased MEP sizes and decreased SICI may reflect mechanisms of interventional plasticity and be potential biomarkers of individualized medicine.

PMID: [30284506](#)

14. Commentary on "Transcranial Direct-Current Stimulation on Motor Function in Pediatric Cerebral Palsy: A Systematic Review".

Kelly N, Heathcock JC.

Pediatr Phys Ther. 2018 Oct;30(4):302. doi: 10.1097/PEP.0000000000000546.

PMID: [30277963](#)

15. Inhospital Complications of Patients With Neuromuscular Disorders Undergoing Total Joint Arthroplasty.

Cichos KH, Lehtonen EJ, McGwin G Jr, Ponce BA, Ghanem ES.

J Am Acad Orthop Surg. 2018 Oct 2. doi: 10.5435/JAAOS-D-18-00312. [Epub ahead of print]

INTRODUCTION: Orthopaedic surgeons are wary of patients with neuromuscular (NM) diseases as a result of perceived poor outcomes and lack of data regarding complication risks. We determined the prevalence of patients with NM disease undergoing total joint arthroplasty (TJA) and characterized its relationship with in-hospital complications, prolonged length of stay, and total charges. **METHODS:** Data from the Nationwide Inpatient Sample from 2005 to 2014 was used for this retrospective cohort study to identify 8,028,435 discharges with total joint arthroplasty. International Classification of Diseases, Ninth Revision, Clinical Modification codes were used to identify 91,420 patients who had discharge diagnoses for any of the NM disorders of interest: Parkinson disease, multiple sclerosis, cerebral palsy, cerebrovascular disease resulting in lower extremity paralysis, myotonic dystrophy, myasthenia gravis, myositis (dermatomyositis, polymyositis, and inclusion-body myositis), spinal muscular atrophy type III, poliomyelitis, spinal cord injury, and amyotrophic lateral sclerosis. Logistic regression was used to estimate the association between NM disease and perioperative outcomes, including inpatient adverse events, length of stay, mortality, and hospital charges adjusted for demographic, hospital, and clinical characteristics. **RESULTS:** NM patients undergoing TJA had increased odds of total surgical complications (odds ratio [OR] = 1.21; 95% confidence interval [CI], 1.17 to 1.25; $P < 0.0001$), medical complications (OR = 1.41; 95% CI, 1.36 to 1.46; $P < 0.0001$), and overall complications (OR = 1.32; 95% CI, 1.28 to 1.36; $P < 0.0001$) compared with non-NM patients. Specifically, NM patients had increased odds of prosthetic complications (OR = 1.09; 95% CI, 0.84 to 1.42; $P = 0.003$), wound dehiscence (OR = 5.00; 95% CI, 1.57 to 15.94; $P = 0.0002$), acute postoperative anemia (OR = 1.20; 95% CI, 1.16 to 1.24; $P < 0.0001$), altered mental status (OR = 2.59; 95% CI, 2.24 to 2.99; $P < 0.0001$), urinary tract infection (OR = 1.45; 95% CI, 1.34 to 1.56; $P < 0.0001$), and deep vein thrombosis (OR = 1.27; 95% CI, 1.02 to 1.58; $P = 0.021$). No difference of in-hospital mortality was observed ($P = 0.155$). **DISCUSSION:** Because more patients with NM disease become candidates of TJA, a team of neurologists, anesthesiologists, therapists, and orthopaedic surgeon is required to anticipate, prevent, and manage potential complications identified in this study. **LEVEL OF EVIDENCE:** Level III, retrospective cohort study.

PMID: [30285988](#)

16. Trunk control and gross motor outcomes after body weight supported treadmill training in young children with severe cerebral palsy: a non-experimental case series.

Flores MB, Da Silva CP.

Dev Neurorehabil. 2018 Oct 5:1-5. doi: 10.1080/17518423.2018.1527862. [Epub ahead of print]

OBJECTIVE: To explore the impact of a body weight supported treadmill training (BWSTT) intervention on postural control and gross motor function in three young children with cerebral palsy (CP) classified as Gross Motor Function Classification System (GMFCS) levels IV or V. **METHOD:** Children (N = 3) between the ages of 2-3 years who were diagnosed with CP classified as GMFCS levels IV and V participated in BWSTT three times per week. The Segmental Assessment of Trunk Control (SATCo) and the gross motor function measure (GMFM-66) were assessed before and after the 6-week intervention. **RESULTS:** Final testing revealed that all participants improved on the SATCo and GMFM. **CONCLUSION:** BWSTT is a viable intervention that may improve trunk control and gross motor outcomes in young children with severe CP. Further research is needed to explore the impact of BWSTT for young children classified as GMFCS levels IV and V.

PMID: [30289316](#)

17. The influence of crouch gait on sagittal trunk position and lower lumbar spinal loading in children with cerebral palsy.

Kiernan D, O'Sullivan R.

Gait Posture. 2018 Sep 6;67:65-70. doi: 10.1016/j.gaitpost.2018.09.003. [Epub ahead of print]

BACKGROUND: Crouch gait is a common pattern in children with CP. Little investigation has been performed as to the role of the trunk during crouch gait. A compensatory movement of the trunk may alter the position of the ground reaction force with the effect of reducing the moment arm about the knee or hip. While this may benefit these joints in the context of reduced loading, there may be implications further up the kinematic chain at the level of the lumbar spine. **RESEARCH QUESTION:** Are compensatory movements of the trunk present during crouch gait in children with CP and are levels of loading at the lower lumbar spine affected? **METHODS:** A full barefoot lower limb and trunk 3-dimensional kinematic and kinetic analysis, with kinetics estimated at the spinal position of L5/S1, was performed on 3 groups of children, namely CP Crouch, CP No-Crouch and TD. Differences in trunk position and L5/S1 loading were compared between groups. **RESULTS:** Mean trunk position in relation to the pelvis and laboratory was not statistically significant between groups. At the level of the spine, no differences were present in mean position between groups for L5/S1 sagittal moment or anterior/posterior force. **SIGNIFICANCE:** Crouch gait does not elicit a compensatory response of the trunk in children with CP and, consequently, reactive forces and moments at the lower lumbar spine remain within normal limits. With this in mind, it is unlikely that a crouch gait pattern will affect the health of the spine over time in these children.

PMID: [30290367](#)

18. Lower limb extension is improved in fast walking condition in children who walk in crouch gait.

Cherni Y, Pouliot Laforte A, Parent A, Marois P, Begon M, Ballaz L.

Disabil Rehabil. 2018 Sep 28;1-6. doi: 10.1080/09638288.2018.1493158. [Epub ahead of print]

BACKGROUND AND PURPOSE: The strategies for walking fast have never been reported in children with cerebral palsy who walk in crouch gait. This study aimed to assess to what extent children who walk in crouch gait are able to increase their gait speed and to report the corresponding three-dimensional kinematic adaptations. **METHODS:** Eleven children and adolescents (aged between 7 and 17 years) with bilateral cerebral palsy, who walk in crouch gait, were asked to walk at their self-selected comfortable speed and then as fast as possible without running. The spatio-temporal and kinematic parameters, as well as the center of mass displacements were compared between walking conditions. **RESULTS:** Children were able to walk 30% faster than their comfortable speed (+0.30 m/s, $p = 0.000$) by increasing both cadence (+21 step/min, $p = 0.000$) and step length (+0.05 m, $p = 0.001$). During the stance phase, pelvis anteversion (+3 Deg, $p = 0.010$), hip flexion-extension range of motion (+4 Deg, $p = 0.002$), and knee extension (+5 Deg, $p = 0.000$) were increased in fast walking. During fast walking, the center of mass showed larger range of vertical displacements ($p < 0.05$). **CONCLUSIONS:** Children with cerebral palsy who walk in crouch gait increased their walking speed by adopting a less crouched posture. Compared to comfortable walking speed condition, fast walking could be beneficial in rehabilitation to solicit higher lower limbs range of motion. Implications for rehabilitation: Children who walk in crouch gait can walk 30% faster Fast walking required higher hip and knee extensions during stance phase Fast walking could be an interesting training modality to improve the lower limb range of motion of children who walk in crouch gait.

PMID: [30266072](#)

19. The head shaft angle is associated with hip displacement in children at GMFCS levels III-V - a population based study.

Finlayson L, Czuba T, Gaston MS, Hägglund G, Robb JE.

BMC Musculoskelet Disord. 2018 Oct 5;19(1):356. doi: 10.1186/s12891-018-2275-4.

BACKGROUND: An increased Head Shaft Angle (HSA) has been reported as a risk factor for hip displacement in children with cerebral palsy (CP) but opinions differ in the literature. The purpose of this study was to re-evaluate the relationship between HSA and hip displacement in a different population of children with CP. **METHODS:** The Cerebral Palsy Integrated Pathway Scotland surveillance programme includes 95% of all children with CP in Scotland. The pelvic radiographs from 640 children in GMFCS levels III-V were chosen. The most displaced hip was analysed and the radiographs used were those taken at the child's first registration in the database to avoid the potential effects of surveillance on subsequent hip centration. A

logistic regression model was used with hip displacement (migration percentage [MP] $\geq 40\%$) as outcome and HSA, GMFCS, age and sex as covariates. RESULTS: The MP was $\geq 40\%$ in 118 hips with a mean HSA of 164° (range $121-180^\circ$) and $< 40\%$ in 522 hips with a mean HSA of 160° (range $111-180^\circ$). The logistic regression analysis showed no significant influence of age and sex on MP in this population but a high GMFCS level was strongly associated with hip displacement. An increased HSA was also associated with hip displacement, a 10° difference in HSA for children adjusted for age, sex, and GMFCS gave an odds ratio of 1.26 for hip displacement equal or above 40% ($p = 0.009$) and hips with HSA above 164.5 degrees had an odds ratio of 1.96 compared with hips with HSA below 164.5 degrees ($p = 0.002$). CONCLUSION: These findings confirm that HSA is associated with hip displacement in children in GMFCS levels III-V.

PMID: [30286753](#)

20. Degraded Synergistic Recruitment of sEMG Oscillations for Cerebral Palsy Infants Crawling.

Gao Z, Chen L, Xiong Q, Xiao N, Jiang W, Liu Y, Wu X, Hou W.

Front Neurol. 2018 Sep 18;9:760. doi: 10.3389/fneur.2018.00760. eCollection 2018.

Background: Synergistic recruitment of muscular activities is a generally accepted mechanism for motor function control, and motor dysfunction, such as cerebral palsy (CP), destroyed the synergistic electromyography activities of muscle group for limb movement. However, very little is known how motor dysfunction of CP affects the organization of the myoelectric frequency components due to the abnormal motor unit recruiting patterns. Objectives: Exploring whether the myoelectric activity can be represented with synergistic recruitment of surface electromyography (sEMG) frequency components; evaluating the effect of CP motor dysfunction on the synergistic recruitment of sEMG oscillations. Methods: Twelve CP infants and 17 typically developed (TD) infants are recruited for self-paced crawling on hands and knees. sEMG signals have been recorded from bilateral biceps brachii (BB) and triceps brachii (TB) muscles. Multi-scale oscillations are extracted via multivariate empirical mode decomposition (MEMD), and non-negative matrix factorization (NMF) method is employed to obtain synergistic pattern of these sEMG oscillations. The coefficient curve of sEMG oscillation synergies are adopted to quantify the time-varying recruitment of BB and TB myoelectric activity during infants crawling. Results: Three patterns of sEMG oscillation synergies with specific frequency ranges are extracted in BB and TB of CP or TD infants. The contribution of low-frequency oscillation synergy of BB in CP group is significantly less than that in TD group ($p < 0.05$) during forward swing phase for slow contraction; however, this low-frequency oscillation synergy keep higher level during the backward swing phase crawling. For the myoelectric activities of TB, there is not enough high-frequency oscillation recruitment of sEMG for the fast contraction in propulsive phase of CP infants crawling. Conclusion: Our results reveal that, the myoelectric activities of a muscle can be manifested as sEMG oscillation synergies, and motor dysfunction of CP degrade the synergistic recruitment of sEMG oscillations due to the impaired CNS regulation and destroyed MU/muscle fiber. Our preliminary work suggests that time-varying coefficient curve of sEMG oscillation synergies is a potential index to evaluate the abnormal recruitment of electromyography activities affected by CP disorders.

PMID: [30279674](#)

21. Walking and Fitness Improvements in a Child With Diplegic Cerebral Palsy Following Motor-Assisted Elliptical Intervention.

Burnfield JM, Cesar GM, Buster TW, Irons SL, Pfeifer CM.

Pediatr Phys Ther. 2018 Oct;30(4):E1-E7. doi: 10.1097/PEP.0000000000000541.

PURPOSE: To quantify effects of motor-assisted elliptical (Intelligently Controlled Assistive Rehabilitation Elliptical [ICARE]) training on walking and fitness of a child with cerebral palsy (CP). KEY POINTS: A 12-year-old boy with walking limitations due to spastic diplegic CP (Gross Motor Function Classification System II) participated in 24 sessions of primarily moderate- to vigorous-intensity ICARE exercise. Fitness improvements were evidenced clinically across sessions by the child's capacity to train for longer periods, at faster speeds, and while overriding motor's assistance. Postintervention, the child walked faster with greater stability and endurance and more rapidly completed the modified Time Up and Go test. CONCLUSION: The child's fitness and gait improved following engagement in a moderate- to vigorous-intensity gait-like exercise intervention. RECOMMENDATIONS FOR CLINICAL PRACTICE: Integration of moderate- to vigorous-intensity motor-assisted elliptical training can promote simultaneous gains in fitness and function for children with CP.

PMID: [30277973](#)

22. Activity Performance Curves of Individuals With Cerebral Palsy.

van Gorp M, Roebroek ME, Swan Tan S, de Groot V, Gorter JW, Smits DW, Schmidt AK, Dallmeijer AJ; PERRIN DECADE Study Group.

Pediatrics. 2018 Oct 4. pii: e20173723. doi: 10.1542/peds.2017-3723. [Epub ahead of print]

OBJECTIVES: Describe development curves of motor and daily activity performance in individuals with cerebral palsy (CP). **METHODS:** Participants with CP aged 1 to 20 years at baseline (n = 421) and Gross Motor Functioning Classification System (GMFCS) levels I to V (27% of participants with intellectual disability [ID]) were longitudinally assessed up to a 13-year follow-up period. Motor and daily activity performance were assessed using the relevant subdomains of the Vineland Adaptive Behavior Scales survey. Nonlinear mixed effects analyses were used, estimating the limit (average maximal performance level) and the age by which individuals reached 90% of the limit (age90). **RESULTS:** Limits of motor performance decreased with each lower functional level. Age90 for motor performance was reached at ~6 to 8 years of age in children with GMFCS levels I to III, and at younger ages in those with lower functional levels. Limits of daily activity performance did not differ between individuals without ID with GMFCS levels I to III. The age90s of daily activities were reached between 11 and 14 (personal), 26 and 32 (domestic), and 22 and 26 years of age (community). Individuals with ID reached lower daily activity performance limits earlier. **CONCLUSIONS:** Individuals with CP continue to develop motor performance after gross motor capacity limits are reached. For those without ID, daily activities continue to develop into their 20s. Individuals who are severely affected functionally have the least favorable development of motor performance, and those with ID have the least favorable development of daily activity performance.

PMID: [30287591](#)

23. Determining energy requirement and evaluating energy expenditure in neurological diseases.

Çekici H, Acar Tek N.

Nutr Neurosci. 2018 Oct 5:1-11. doi: 10.1080/1028415X.2018.1530180. [Epub ahead of print]

OBJECTIVES: It has been reported that in most neurological patients, resting energy expenditure due to hypermetabolism is increased. Physical activity, which is another component of energy expenditure, varies depending on the course of the disease. Different mechanisms are used to explain changes in energy expenditure in this population. Pathological problems of centers that regulate energy balance in the brain, endocrine and metabolic dysfunction, mitochondrial damage, autonomic dysfunction and inflammatory anomalies are thought to be at the root of this situation. In this review study, studies about energy expenditure and energy requirement in neurological diseases have been examined and suggested practices in this field have been presented. **METHODS:** We reviewed articles regarding selected from PubMed, Science Direct, EBSCO, and databases about energy expenditure and neurological diseases. **RESULTS:** Based on the type of neurological diseases; factors such as stage of the disease, disease complications, metabolic status, mechanical ventilation, body composition, movement restrictions or hyperactivity change energy expenditure and, as a result, nutrition requirement. Determination of the energy requirement is the basic variable for adjusting medical nutrition therapy. Despite an increase in resting energy expenditure as a result of metabolic processes in most neurological disorders, the daily energy expenditure is reported to change based on the restriction of physical activity due to the disorder. **DISCUSSION:** Determining patient's energy expenditure and energy requirements is regarded as the right approach in terms of improving the patient's quality of life, regulating appropriate medical nutrition treatment and increasing the effectiveness of other treatments.

PMID: [30289025](#)

24. Training methods and analysis of races of a top level Paralympic swimming athlete.

Puce L, Marinelli L, Pierantozzi E, Mori L, Pallecchi I, Bonifazi M, Bove M, Franchini E, Trompetto C.

J Exerc Rehabil. 2018 Aug 24;14(4):612-620. doi: 10.12965/jer.1836254.127. eCollection 2018 Aug.

Training methods for Paralympic swimmers must take into account different pathologies, competitions classes, athlete's individual circumstances and peculiar physical adaptation mechanisms, hence general guidelines cannot be found in literature. In this study we present a training program, implemented for the physical preparation of a top level Paralympic swimmer. The athlete under study, affected by infantile cerebral palsy within a clinical picture of a spastic tetraparesis, by the end of 2016 was holder of Italian, European, world and Paralympic titles in the 400-m freestyle competition, S6 class. The training macrocycle was structured in a 3-fold periodization (three mesocycles), in view of the preparation to three international competitions. The 4-month training mesocycles prior to each competition differed substantially in terms of mileage load, intensity and recovery

times. The first mesocycle was characterized by a sizeable low-intensity mileage load, the second one was shifted to lower mileage load, carried out at middle-to-high intensity levels, the third one entailed increased effort intensity, counterbalanced by lower mileage load. In all cases, recovery times were balanced to obtain optimized performance through physical adaptation to training stimuli, keeping into account the physiopathological response. Tapering phases were adjusted to maximize performance at competition. As an assessment of the effectiveness of the training method, correspondence between chronometric and technical parameters in the three competitions and the respective mesocycle training programs was found. The results of the present study may support the development of training guidelines for athletes affected by upper motor neuron lesions.

PMID: [30276182](#)

25. Comparison of Habitual Physical Activity and Sedentary Behavior in Adolescents and Young Adults With and Without Cerebral Palsy.

Aviram R, Harries N, Shkedy Rabani A, Amro A, Nammourah I, Al-Jarrah M, Raanan Y, Hutzler Y, Bar-Haim S.

Pediatr Exerc Sci. 2018 Oct 1:1-7. doi: 10.1123/pes.2017-0285. [Epub ahead of print]

PURPOSE: The comparison of habitual physical activity and sedentary time in teenagers and young adults with cerebral palsy (CP) with typically developed (TD) peers can serve to quantify activity shortcomings. **METHODS:** Patterns of sedentary, upright, standing, and walking components of habitual physical activity were compared in age-matched (16.8 y) groups of 54 youths with bilateral spastic CP (38 who walk with limitations and 16 who require mobility devices) and 41 TD youths in the Middle East. Activity and sedentary behavior were measured over 96 hours by activPAL3 physical activity monitors. **RESULTS:** Participants with CP spent more time sedentary (8%) and sitting (37%) and less time standing (20%) and walking (40%) than TD (all P s < .01). These trends were enhanced in the participants with CP requiring mobility devices. Shorter sedentary events (those <60-min duration) were similar for TD and CP groups, but CP had significantly more long sedentary events (>2 h) and significantly fewer upright events (taking <30, 30-60, and >60 min) and less total upright time than TD. **CONCLUSION:** Ambulant participants with CP, as well as TD youth must be encouraged to take more breaks from being sedentary and include more frequent and longer upright events.

PMID: [30272530](#)

26. Age at referral for diagnosis and rehabilitation services for cerebral palsy: a scoping review.

Boychuck Z, Bussi eres A, Goldschleger J, Majnemer A; Prompt Group.

Dev Med Child Neurol. 2018 Oct 1. doi: 10.1111/dmcn.14034. [Epub ahead of print]

AIM: This study sought to: (1) determine what is known about age at referral for diagnosis and rehabilitation services for children suspected of having cerebral palsy (CP); and (2) identify factors associated with earlier referral. **METHOD:** A scoping review was conducted to summarize existing literature. We systematically searched Allied and Complementary Medicine, CINAHL, Cochrane Library, Embase, and PsycINFO for evidence published between 1979 and 2017 on age at referral for diagnosis or age at referral to rehabilitation services for children suspected of having CP. Quantitative and thematic analyses of the literature were performed. **RESULTS:** Our search yielded 777 articles, of which 15 met the inclusion criteria. Only one study focused on age at referral for diagnosis of CP (mean 16.6mo±19.2mo), with two on age at referral to rehabilitation services (means 13.9mo±15.8mo and 12.4mo). Potential predictors of earlier referral identified include referral source, type of CP, and a complicated birth history. **INTERPRETATION:** Evidence is sparse; however, available studies suggest high variation in the age at which children are being referred for diagnosis, typically ranging from 10 months to 21 months. Evidence indicates that subgroups of children with CP might be experiencing prolonged delays. Findings highlight the need to better understand what contributes to delays in referral for diagnosis and rehabilitation. **WHAT THIS PAPER ADDS:** Evidence on age at referral for diagnosis of cerebral palsy is sparse. Potential predictors of delayed referral represent targets to minimize delays in diagnosis. A subset of children may be experiencing unnecessary delays in referral.

PMID: [30273970](#)

27. The Baby Moves smartphone app for General Movements Assessment: Engagement amongst extremely preterm and term-born infants in a state-wide geographical study.

Kwong AK, Eeles AL, Olsen JE, Cheong JL, Doyle LW, Spittle AJ.

J Paediatr Child Health. 2018 Oct 4. doi: 10.1111/jpc.14240. [Epub ahead of print]

AIM: The Baby Moves smartphone application is designed for parents to video their infants' spontaneous movement for remote General Movements Assessment (GMA). We aimed to assess the engagement with Baby Moves amongst high- and low-risk infants' families and the socio-demographic variables related to engagement. **METHODS:** Families of extremely preterm (EP; <28 weeks' gestational age) or extremely low-birthweight (ELBW; <1000 g) infants and term-born controls from a state-wide geographical cohort study were asked to download Baby Moves. Baby Moves provided reminders and instructions to capture videos of their infants' general movements. Parents were surveyed about Baby Moves' usability. **RESULTS:** The parents of 451 infants (226 EP/ELBW; 225 control) were recruited; 416 (204 EP/ELBW; 212 control) downloaded Baby Moves, and 346 (158 EP/ELBW; 188 control) returned at least one scorable video for remote GMA. Fewer EP/ELBW families submitted a scorable video than controls (70 vs. 83%, respectively; odds ratio (OR) 0.48, 95% confidence interval (CI) 0.3-0.79, $P = 0.003$), but the difference diminished when adjusted for socio-demographic variables (OR 1.09, 95% CI 0.59-2.0, $P = 0.79$). Families who received government financial support (OR 0.28, 95% CI 0.1-0.78, $P = 0.015$), who spoke limited English at home (OR 0.39, 95% CI 0.22-0.69, $P = 0.001$) or with lower maternal education (OR 0.38, 95% CI 0.21-0.68, $P = 0.001$) were less likely to return a scorable video. Surveyed parents responded mostly positively to Baby Moves' usability. **CONCLUSIONS:** Most parents in this study successfully used Baby Moves to capture infant movements for remote GMA. Families of lower socio-demographic status used Baby Moves less.

PMID: [30288823](#)

28. Reliability and predictive validity of the Standardized Infant NeuroDevelopmental Assessment neurological scale.

Hadders-Algra M, Tacke U, Pietz J, Rupp A, Philippi H.

Dev Med Child Neurol. 2018 Oct 1. doi: 10.1111/dmcn.14045. [Epub ahead of print]

AIM: To assess reliability and predictive validity of the neurological scale of the Standardized Infant NeuroDevelopmental Assessment (SINDA), a recently developed assessment for infants aged 6 weeks to 12 months. **METHOD:** To assess reliability, three assessors independently rated video-recorded neurological assessments of 24 infants twice. Item difficulty and discrimination were determined. To evaluate predictive validity, 181 infants (median gestational age 30wks [range 22-41wks]; 92 males, 89 females) attending a non-academic outpatient clinic were assessed with SINDA's neurological scale (28 dichotomized items). Atypical neurodevelopmental outcome at 24 months or older corrected age implied a Bayley Mental Developmental Index or Psychomotor Developmental Index lower than 70 or a diagnosis of cerebral palsy (CP). Predictive values were calculated from SINDA (2-12mo corrected age, median 3mo) and typical versus atypical outcome. **RESULTS:** Intraclass correlation coefficients of intrarater and interrater agreement of the neurological score varied between 0.923 and 0.965. Item difficulty and discrimination were satisfactory. At 24 months or older, 56 children (31%) had an atypical outcome (29 had CP). Atypical neurological scores (below 25th centile, ≤ 21) predicted atypical outcome and CP with sensitivities of 89% and 100%, and specificities of 94% and 81% respectively. **INTERPRETATION:** SINDA's neurological scale is reliable and in a non-academic outpatient setting has a satisfactory predictive validity for atypical developmental outcome, including CP, at 24 months or older. **WHAT THIS PAPER ADDS:** The Standardized Infant NeuroDevelopmental Assessment's neurological scale has a good to excellent reliability. The scale has promising predictive validity for cerebral palsy. The scale has promising predictive validity for other types of atypical developmental outcome.

PMID: [30276806](#)

29. Evaluation of Feeding Disorders Including Gastro-Esophageal Reflux and Oropharyngeal Dysfunction in Children With Cerebral Palsy.

Asgarshirazi M, Farokhzadeh-Soltani M, Keihanidost Z, Shariat M.

J Family Reprod Health. 2017 Dec;11(4):197-201.

Objective: This cross sectional study aims to survey developing feeding disorders and nutritional deficiencies disorders in children with neurodevelopmental disorders such as cerebral palsy. **Materials and methods:** A total of 50 children (28 boys and 22 girls) with cerebral palsy and symptoms suggesting gastrointestinal problems such as choking, recurrent pneumonia and poor weight gain, who referred to the Pediatric department of Vali-asr Hospital, Imam Khomeini hospital complex between 1 October 2012 and 30 October 2013, were checked. Motor function classification system was used to classify patient's functional gross motor severity. All patients were examined and underwent deglutition videofluoroscopy (modified barium swallow) and upper GI endoscopy with esophageal biopsies. Outcome of this study was the prevalence of oropharyngeal incoordination and GERD. Its relationship with some variables like motor and cognitive developmental delay were analyzed and p value < 0.05 was considered significant. Medical therapy and/or oral physiotherapy and nutritional rehabilitation were

started. They were examined after 6 months of treatment. Decrease in choking and episodes of respiratory infections that needed hospitalization and weight gain after 6 months treatment were considered as secondary outcomes (response to treatment). Results: Prevalence of GERD was 66% and oropharyngeal dysphagia was estimated 82%. According to results of video-fluoroscopy and endoscopic biopsies, 52% of patients were affected by both GERD and oropharyngeal dysfunction. The gross motor function disability was the only variable that significantly related to the prevalence of feeding disorders ($p = 0.015$). Despite nutritional rehabilitation only 46% of children have weight gain. Conclusion: Feeding disorders such as GERD and oropharyngeal dysfunction are more prevalent in children with cerebral palsy especially in children with severe gross motor disabilities. Since, clinical manifestations of these disorders can be similar accurate diagnostic methods should be selected for all children with cerebral palsy and gastrointestinal symptoms. Treatment should start early to reduce the complications and improve outcomes.

PMID: [30288166](#)

30. Behavioural interventions to treat drooling in children with neurodisability: a systematic review.

Mcinerney MS, Reddihough DS, Carding PN, Swanton R, Walton CM, Imms C.

Dev Med Child Neurol. 2018 Oct 1. doi: 10.1111/dmcn.14048. [Epub ahead of print]

AIM: To review the evidence for behavioural interventions to reduce drooling in children with neurodisability. METHOD: A detailed search in eight databases sought studies that: (1) included participants aged 0 to 18 years with neurodisability and drooling; (2) provided behavioural interventions targeting drooling or a drooling-related behaviour; and (3) used experimental designs. Two reviewers extracted data from full-text papers independently. Results were tabulated for comparison. The Risk of Bias assessment in N-of-1 Trials scale for single case experimental designs (SCEDs) and the Cochrane risk of bias assessment tool for randomized controlled trials (RCTs) were applied. RESULTS: Of an initial yield of 763, seven SCEDs and one RCT were included. Behavioural interventions included the use of reinforcement, prompting, self-management, instruction, extinction, overcorrection, and fading. Each assessed body functions or structures' outcomes (drooling frequency and severity); three included activity outcomes (mouth drying, head control, eye contact, and vocalizations) and none assessed participation or quality of life. While each study reported positive effects of intervention, risk of bias was high. INTERPRETATION: Low-level evidence suggests behavioural interventions may be useful for treatment of drooling in children with neurodisability. Well-designed intervention studies are urgently needed to determine effectiveness. WHAT THIS PAPER ADDS: Behavioural interventions used to treat drooling included reinforcement, prompting, self-management, extinction, overcorrection, instruction, and fading. Interventions targeted body structures and function-level outcomes and activity-level outcomes. Low-level evidence supports the use of behavioural intervention to treat drooling.

PMID: [30276810](#)

31. Characteristics of Speech Rate in Children With Cerebral Palsy: A Longitudinal Study.

Darling-White M, Sakash A, Hustad KC.

J Speech Lang Hear Res. 2018 Oct 2;1-14. doi: 10.1044/2018_JSLHR-S-17-0003. [Epub ahead of print]

PURPOSE: The purpose of this longitudinal study was to examine the effect of time and sentence length on speech rate and its characteristics, articulation rate and pauses, within 2 groups of children with cerebral palsy (CP). METHOD: Thirty-four children with CP, 18 with no speech motor involvement and 16 with speech motor involvement, produced sentences of varying lengths at 3 time points that were 1 year apart (mean age = 56 months at first time point). Dependent measures included speech rate, articulation rate, proportion of time spent pausing, and average number and duration of pauses. RESULTS: There were no significant effects of time. For children with no speech motor involvement, speech rate increased with longer sentences due to increased articulation rate. For children with speech motor involvement, speech rate did not change with sentence length due to significant increases in the proportion of time spent pausing and average number of pauses in longer sentences. CONCLUSIONS: There were no significant age-related differences in speech rate in children with CP regardless of group membership. Sentence length differentially impacted speech rate and its characteristics in both groups of children with CP. This may be due to cognitive-linguistic and/or speech motor control factors.

PMID: [30286232](#)

32. Games Used With Serious Purposes: A Systematic Review of Interventions in Patients With Cerebral Palsy.

Lopes S, Magalhães P, Pereira A, Martins J, Magalhães C, Chaleta E, Rosário P.

Front Psychol. 2018 Sep 19;9:1712. doi: 10.3389/fpsyg.2018.01712. eCollection 2018.

The purpose of the present systematic review was to examine extant research regarding the role of games used seriously in interventions with individuals with cerebral palsy. Therefore, PubMed, PsYINFO, Web of Science, Scopus, and IEEE databases were used. Search terms included: "serious games" OR "online games" OR "video games" OR "videogame" OR "game based" OR "game" AND "intervention" AND "cerebral palsy." After the full reading and quality assessment of the papers, 16 studies met the inclusion criteria. The majority of the studies reported high levels of compliance, motivation, and engagement with game-based interventions both at home and at the clinical setting intervention. Regarding the effectiveness of the use of games, the results of the studies show both positive and negative results regarding their effectiveness. The efficacy was reported to motor function (i.e., improvements in the arm function, hand coordination, functional mobility, balance and gait function, postural control, upper-limbs function) and physical activity. Findings of this review suggest that games are used as a complement to conventional therapies and not as a substitute. Practitioners often struggle to get their patients to complete the assigned homework tasks, as patients display low motivation to engage in prescribed exercises. Data of this review indicates the use of games as tools suited to promote patients' engagement in the therapy and potentiate therapeutic gains.

PMID: [30283377](#)

33. Commentary on "Effects of a Gaming Platform on Balance Training for Children With Cerebral Palsy".

Flores G, Ordorica J.

Pediatr Phys Ther. 2018 Oct;30(4):309. doi: 10.1097/PEP.0000000000000539.

PMID: [30277964](#)

34. A Web-Based Caring Training for Caregivers of Children with Cerebral Palsy: Development and Evaluation.

Nobakht Z, Rassafiani M, Hosseini SA.

Iran J Child Neurol. 2018 Fall;12(4):65-84.

OBJECTIVES: Caregivers of children with cerebral palsy (CP) have to spend a long time to take care of their children. We aimed to develop a user-friendly web-based intervention for training parents of children with CP and evaluate the process of development using modified CeHRes roadmap. **MATERIALS & METHODS:** The study was conducted from September 2016 to September 2017 in Tehran, Iran. We did it in four main steps including determining the needs of users, content development, design, operational development and evaluation. **RESULTS:** The website for caregiver training provided nine general topics and had the possibility that the caregivers could determine their educational priorities. Moreover, the users could share their experiences with other users and could ask questions from an expert. Ten caregivers completed a usability questionnaire after four weeks of use. The average score of 70.5 out of 100 was shown among caregivers. The average score of all statements was above three on a Likert scale between 1 and 5. **CONCLUSION:** The website has the possibilities including registering caregivers of children with CP, the possibility to confirm registration with an SMS and the possibility to determine the caregiver educational priorities. It has the usability for training caregivers of children with CP.

PMID: [30279710](#)

35. Feasibility and Utility of Tele-Neurorehabilitation Service in India: Experience from a Quaternary Center.

Khanna M, Gowda GS, Bagevadi VI, Gupta A, Kulkarni K, S Shyam RP, Basavaraju V, Ramesh MB, Sashidhara HN, Manjunatha N, Channaveerachari NK, Math SB.

J Neurosci Rural Pract. 2018 Oct-Dec;9(4):541-544. doi: 10.4103/jnrp.jnrp_104_18.

BACKGROUND: Neurological rehabilitation service in developing countries like India is a great challenge in view of limited resources and manpower. Currently, neurological rehabilitation with a multidisciplinary team is limited to a few major cities in the country. Tele-neurorehabilitation (TNR) is considered as an alternative and innovative approach in health care. It connects the needy patients with the health-care providers with minimum inconvenience and yields cost-effective health care. **AIM:** The aim of this study was to study the socioclinical parameters, feasibility, and utility of TNR services in India. **METHODOLOGY:** A retrospective file review of TNR consultations provided through Telemedicine Center at a quaternary hospital-based research center in south India between August 2012 and January 2016. **RESULTS:** A total of 37 consultations were provided to the patients belonging to four districts of Karnataka. The mean age of the patients was 34.7 (\pm 19.5) years, 23 (62.1%) were aged

between 19 and 60 years, and 31 (83.8%) were male. Thirty-one patients (83.8%) had central nervous system-related disorders such as stroke, cerebral palsy, and tubercular meningitis with sequelae or neuromuscular disorders such as Guillain-Barre Syndrome and Duchenne muscular dystrophy. Twelve patients (32.4%) were advised to consult higher centers in the vicinity, and the rest was referred to the district hospital. **CONCLUSION:** The findings suggest that TNR services are feasible, effective, and less resource intensive in delivering quality telemedicine care in India. More clinical studies are required to elucidate its full utility at different levels and in different parts of the country.

PMID: [30271047](#)

36. Acute Hemiplegia in Children: A Prospective Study of Etiology, Clinical Presentation, and Outcome from Western India.

Chinnabhandar V, Singh A, Mandal A, Parmar BJ.

J Neurosci Rural Pract. 2018 Oct-Dec;9(4):504-509. doi: 10.4103/jnrp.jnrp_574_17.

BACKGROUND: Hemiplegia/hemiparesis denotes the weakness of one side of the body. In contrast to adults, hemiparesis in children occurs secondary to a variety of etiological conditions. **AIMS:** The aim of this study was to assess the clinical, laboratory, and radiological features of children with acquired hemiparesis/hemiplegia of nontraumatic origin and intended to find its underlying etiology in the Indian children. **SETTINGS AND DESIGN:** This prospective, observational study was carried out at a tertiary care hospital in western India. **MATERIALS AND METHODS:** Children aged between 3 months and 14 years admitted to the in-patient department of a tertiary care hospital with acquired hemiparesis/hemiplegia were included over 2 years. Children with perinatal insult, preexisting neurological diseases, neurotrauma, hemiplegic migraine, and Todd's paralysis were excluded from the study. Detailed clinical examination, laboratory, and radiological investigations were done, and an attempt was made to find the underlying etiology. These children were also followed up after 1 month of discharge to look at short-term outcomes. All clinical information was recorded in a predesigned performa and was managed with Microsoft Excel spreadsheet. Frequency was presented as number (N) and percentage (%). **RESULTS:** Fifty-five children (male:female = 1.2:1), predominantly between 1 and 5 years of age were studied. Apart from weakness (92.8%), vomiting (70.9%), fever (58.2%), and seizure (58.2%) were the predominant presenting complaints. One-fifth of them had comorbidities; most commonly congenital heart disease. Cerebral infarction was the most common pathology in neuroimaging. Central nervous system infection (45.5%) was the most common identified etiology followed by vascular events (21.8%). Among those who could be followed up at 1 month, about 65% had some improvement in their power. **CONCLUSION:** Infections continue to be an important cause of neurodisability in the developing countries.

PMID: [30271041](#)

37. Differentiation enhances Zika virus infection of neuronal brain cells.

Sánchez-San Martín C, Li T, Bouquet J, Streithorst J, Yu G, Paranjpe A, Chiu CY.

Sci Rep. 2018 Sep 28;8(1):14543. doi: 10.1038/s41598-018-32400-7.

Zika virus (ZIKV) is an emerging, mosquito-borne pathogen associated with a widespread 2015-2016 epidemic in the Western Hemisphere and a proven cause of microcephaly and other fetal brain defects in infants born to infected mothers. ZIKV infections have been also linked to other neurological illnesses in infected adults and children, including Guillain-Barré syndrome (GBS), acute flaccid paralysis (AFP) and meningoencephalitis, but the viral pathophysiology behind those conditions remains poorly understood. Here we investigated ZIKV infectivity in neuroblastoma SH-SY5Y cells, both undifferentiated and following differentiation with retinoic acid. We found that multiple ZIKV strains, representing both the prototype African and contemporary Asian epidemic lineages, were able to replicate in SH-SY5Y cells. Differentiation with resultant expression of mature neuron markers increased infectivity in these cells, and the extent of infectivity correlated with degree of differentiation. New viral particles in infected cells were visualized by electron microscopy and found to be primarily situated inside vesicles; overt damage to the Golgi apparatus was also observed. Enhanced ZIKV infectivity in a neural cell line following differentiation may contribute to viral neuropathogenesis in the developing or mature central nervous system.

PMID: [30266962](#)

38. Birth Anomalies in Monozygotic and Dizygotic Twins: Results From the California Twin Registry.

Yu Y, Cozen W, Hwang AE, Cockburn MG, Zadnick J, Hamilton AS, Mack T, Figueiredo JC.

J Epidemiol. 2018 Sep 29. doi: 10.2188/jea.JE20170159. [Epub ahead of print]

BACKGROUND: Inherited factors and maternal behaviors are thought to play an important role in the etiology of several congenital malformations. Twin studies can offer additional evidence regarding the contribution of genetic and lifestyle factors to common birth anomalies, but few large-scale studies have been reported. **METHODS:** We included data from twins (20,803 pairs) from the population-based California Twin Program. We compared concordance in monozygotic (MZ) to dizygotic (DZ) twins for the following birth anomalies: clubfoot, oral cleft, spina bifida, muscular dystrophy, deafness, cerebral palsy, strabismus, and congenital heart defects. Each birth anomaly was also examined for the associations with birth characteristics (birthweight and birth order) and parental exposures (age, smoking, and parental education). **RESULTS:** The overall prevalence of any selected birth anomaly in California twins was 38 per 1,000 persons, with a slightly decreasing trend from 1957-1982. For pairwise concordance in 6,752 MZ and 7,326 like-sex DZ twin pairs, high MZ:DZ concordance ratios were observed for clubfoot (CR 5.91; $P = 0.043$) and strabismus (CR 2.52; $P = 0.001$). Among the total 20,803 pairs, parental smoking was significantly associated with risk of spina bifida (OR 3.48; 95% CI, 1.48-8.18) and strabismus (OR 1.61; 95% CI, 1.28-2.03). A significant quadratic trend of increasing risk for clubfoot, spina bifida, and strabismus was found when examining whether father smoked, mother smoked, or both parents smoked relative to non-smoking parents ($P = 0.029$, 0.026 , and 0.0005 , respectively). **CONCLUSIONS:** Our results provide evidence for a multifactorial etiology underlying selected birth anomalies. Further research is needed to understand the biological mechanisms.

PMID: [30270263](#)

39. Cockayne Syndrome Misdiagnosed as Cerebral Palsy.

Vafae A, Baghdadi T, Norouzzadeh S.

Iran J Child Neurol. 2018 Fall;12(4):162-168.

A 7-yr-old patient was referred to pediatric orthopedic clinic of Imam hospital (2016) with the diagnosis of cerebral palsy (CP). His parents were concerned about some inconsistency of his disease progression. After initial evaluations, the diagnosis of CP was incorrect. The true diagnosis was suspected and confirmed with molecular genetic analysis. A rare autosomal recessive disorder -Cockayne syndrome- was diagnosed. Although untreatable, it can be prevented by appropriate prenatal diagnostic tests for their future children.

PMID: [30279719](#)

40. Glutaric Aciduria Type 1 with Microcephaly: Masquerading as Spastic Cerebral Palsy.

Sharawat IK, Dawman L.

J Pediatr Neurosci. 2018 Jul-Sep;13(3):349-351. doi: 10.4103/JPN.JPN_79_17.

Glutaric aciduria type 1 (GA-1) is an autosomal-recessive disorder caused by the deficiency of the mitochondrial enzyme glutaryl-CoA dehydrogenase. A 13-month-old boy presented with microcephaly, developmental delay, and progressive spasticity and was being treated as spastic cerebral palsy, later on had loss of developmental milestones after acute episode of illness at 12 months of age. The magnetic resonance imaging of brain revealed widened Sylvian fissure, hyperintensities in bilateral globus pallidus, and bilateral frontoparietal atrophy along with white matter loss. The urine examination by gas chromatography-mass spectroscopy revealed a marked excretion of glutaric acid and 3-hydroxyglutaric acid. The diagnosis of GA-1 was confirmed on the basis of characteristic neuroimaging, biochemical, and mutation studies. There are rare reports in the literature about association of GA-1 with microcephaly. The child was started on trihexyphenidyl, l-carnitine, and high-dose riboflavin, and dietary therapy in the form of low-protein diet was advised.

PMID: [30271473](#)

Prevention and Cure

41. Immunization status of mothers of children with cerebral palsy in rural Bangladesh.

Khan A, Ashher F, Karim T, Fatema A, Jahan I, Muhit M, Dey A, Beard F, Khandaker G.

Infect Disord Drug Targets. 2018 Oct 1. doi: 10.2174/1871526518666181001140817. [Epub ahead of print]

BACKGROUND: Vaccination is one of the most effective public health tools for prevention of infectious diseases, morbidity and disability. Little is known about the rate of maternal immunization among mothers of children with cerebral palsy (CP), as well as any possible role of maternal immunization in development of CP in the newborns. **OBJECTIVE:** To determine the socio-demographic characteristics and self-reported vaccination status of mothers of children with CP and compare vaccination coverage in this cohort with national data on immunization. The study also aims to assess vaccination status of children with CP. **METHOD:** A subset of the Bangladesh CP Register (BCPR) cohort of women who had children with CP were recruited during April 2017 from a community based early intervention and rehabilitation program going on in Shahjardpur. Socio-demographic characteristics and maternal immunization status were assessed using a semi-structured questionnaire. The vaccination status of the children was also assessed by interviewing mother and observing the BCG marks. All data were compared with the corresponding information among general population using national vaccination coverage survey reports of the Ministry of Health and Family Welfare, Bangladesh. **RESULT:** Sixty-eight mothers were interviewed of which 17.6% mothers reported not receiving any vaccine during pregnancy. Tetanus vaccine was most commonly (82.0%) received during pregnancy. Overall coverage for at least two doses of tetanus toxoid (TT) among mothers of children with CP was significantly lower than the national tetanus coverage (79.4% versus 96.4%, $p < 0.01$). Forty two (61.7%) mothers with a child with CP reported to have not received tetanus vaccine during their pregnancy compared to only twenty (29.4%) mothers with healthy children reported missing tetanus vaccination during their pregnancy. This difference was statistically significant ($p < 0.01$). Hepatitis B and influenza vaccine were received by mothers of children with CP during antenatal period (2 and 6 respectively). **CONCLUSION:** Immunization among mothers of children with CP is significantly poorer than the national coverage. Also, the immunization of the children with CP is poorer than the national EPI coverage. Our findings reflect that necessity for specific strategies to improve the vaccination coverage among mothers of children with disabilities especially CP and the children with CP.

PMID: [30277171](#)

42. Therapeutic hypothermia and targeted temperature management for traumatic brain injury: Experimental and clinical experience.

Dietrich WD, Bramlett HM.

Brain Circ. 2017 Oct-Dec;3(4):186-198. doi: 10.4103/bc.bc_28_17. Epub 2017 Dec 29.

Traumatic brain injury (TBI) is a worldwide medical problem, and currently, there are few therapeutic interventions that can protect the brain and improve functional outcomes in patients. Over the last several decades, experimental studies have investigated the pathophysiology of TBI and tested various pharmacological treatment interventions targeting specific mechanisms of secondary damage. Although many preclinical treatment studies have been encouraging, there remains a lack of successful translation to the clinic and no therapeutic treatments have shown benefit in phase 3 multicenter trials. Therapeutic hypothermia and targeted temperature management protocols over the last several decades have demonstrated successful reduction of secondary injury mechanisms and, in some selective cases, improved outcomes in specific TBI patient populations. However, the benefits of therapeutic hypothermia have not been demonstrated in multicenter randomized trials to significantly improve neurological outcomes. Although the exact reasons underlying the inability to translate therapeutic hypothermia into a larger clinical population are unknown, this failure may reflect the suboptimal use of this potentially powerful therapeutic in potentially treatable severe trauma patients. It is known that multiple factors including patient recruitment, clinical treatment variables, and cooling methodologies are all important in yielding beneficial effects. High-quality multicenter randomized controlled trials that incorporate these factors are required to maximize the benefits of this experimental therapy. This article therefore summarizes several factors that are important in enhancing the beneficial effects of therapeutic hypothermia in TBI. The current failures of hypothermic TBI clinical trials in terms of clinical protocol design, patient selection, and other considerations are discussed and future directions are emphasized.

PMID: [30276324](#)

43. Safely lowering the emergency Cesarean and operative vaginal delivery rates using the Fetal Reserve Index.

Eden RD, Evans MI, Britt DW, Evans SM, Schiffrin BS.

J Matern Fetal Neonatal Med. 2018 Oct 1:1-7. doi: 10.1080/14767058.2018.1519799. [Epub ahead of print]

OBJECTIVE: The cardiotocograph (CTG) or electronic fetal monitoring (EFM) was developed to prevent fetal asphyxia and subsequent neurological injury. From a public health perspective, it has failed these objectives while increasing emergency

operative deliveries (emergency operative deliveries (EODs) - emergency cesarean delivery or operative vaginal delivery) for newborns, who in retrospect, actually did not require the assistance. EODs increase the risks of complications and stress for patients, families, and medical personnel. A safe reduction in the need for EOD will likely reduce both the overall Cesarean section rate as well as the risk of fetal neurological injury during labor to which it is related. We have developed the fetal reserve index (FRI), which is more comprehensive than CTG as a new screening method for early identification of the fetus at-risk of both neurological harm and the need to "rescue" by means of an EOD. Here, we compare prospectively the need for EOD in two groups of parturients undergoing a trial of labor at term. One group was managed conventionally, the other by the principles of the FRI. **STUDY DESIGN:** We compared the need for EOD of 800 parturients with singleton cases undergoing a trial of labor at term entering with normal CTG patterns (ACOG category 1). Patients were either treated routinely (400 - "early cases") or in a second group seen later actively managed using the principles of the FRI (400 - "late cases"). The FRI includes measurements of five components of the CTG: rate, variability, decelerations, accelerations, and abnormal uterine activity combined with the presence of medical, obstetrical, and fetal risk factors. The 8-point metric categorizes cases as "green", "yellow", and "red" with the latter being at risk. **RESULTS:** All 800 patients delivered babies, who were discharged in the usual time course with no untoward outcomes noted. The incidence of red zone scores was comparable in the two groups ($\approx 25\%$), but the use of intrauterine resuscitation (IR) when reaching the red zone in the late group (47%) was more than double the incidence in the early group (20%) ($p < .001$). Despite (or because of) this, EODs were significantly reduced in the late group, from 17.3 to 4.0% ($p < .001$). Further, the late group spent less time in the red zone without increasing overall time in labor. Overall, EOD cases averaged >1 h in the red zone versus 0.5 h for non-EODs. **CONCLUSIONS:** The FRI may provide a metric to reduce EODs and by extension also reduce the risks of both cesarean delivery and adverse fetal/neonatal outcomes. The safe avoidance of EOD would seem to be an important metric to assess the quality of intrapartum management. This study represents the first attempt to apply the principles of the FRI "live" for the concurrent management of patients during labor. These promising results, if confirmed, in larger sample sizes, set the stage for our computerization of the FRI for widespread study. Benefits appear to come from identification and early, conservative management of fetal deterioration before the need to "rescue" the fetus by EOD.

PMID: [30269624](https://pubmed.ncbi.nlm.nih.gov/30269624/)