Ferre CL, Carmel JB, Flamand VH, Gordon AM, Friel KM.


Background. Variability in hand function among children with unilateral cerebral palsy (UCP) might reflect the type of brain injury and resulting anatomical sequelae. Objective. We used atlas-based analysis of structural images to determine whether children with periventricular (PV) versus middle cerebral artery (MCA) injuries might exhibit unique anatomical characteristics that account for differences in hand function. Methods. Forty children with UCP underwent structural brain imaging using 3-T magnetic resonance imaging. Brain lesions were classified as PV or MCA. A group of 40 typically developing (TD) children served as comparison controls. Whole brains were parcellated into 198 structures (regions of interest) to obtain volume estimates. Dexterity and bimanual hand function were assessed. Unbiased, differential expression analysis was performed to determine volumetric differences between PV and MCA groups. Principal component analysis (PCA) was performed and the top 3 components were extracted to perform regression on hand function. Results. Children with PV had significantly better hand function than children with MCA. Multidimensional scaling analysis of volumetric data revealed separate clustering of children with MCA, PV, and TD children. PCA extracted anatomical components that comprised the 2 types of brain injury. In the MCA group, reductions of volume were concentrated in sensorimotor structures of the injured hemisphere. Models using PCA predicted hand function with greater accuracy than models based on qualitative brain injury type. Conclusions. Our results highlight unique quantitative differences in children with UCP that also predict differences in hand function. The systematic discrimination between groups found in our study reveals future questions about the potential prognostic utility of this approach.

PMID: 31983314

Quadrelli E, Anzani A, Ferri M, Bolognini N, Maravita A, Zambonin F, Turati C.


Action Observation Treatment (AOT) has been shown to be effective on the functional recovery of several clinical populations. However, little is known about the neural underpinnings of the clinical efficacy of AOT in children with Cerebral Palsy (CP). Using electroencephalography (EEG), we recorded μ rhythm desynchronization as an index of sensorimotor cortex modulation during a passive action observation task before and after AOT. The relationship between sensorimotor modulation and clinical outcomes was also assessed. Eight children with CP entered the present randomized controlled crossover pilot study in which the experimental AOT preceded or followed a control Videogame Observation Treatment (VOT). Results provide further evidence of the clinical efficacy of AOT for improving hand motor function in CP, as assessed...
with the Assisting Hand Assessment (AHA) and Melbourne Assessment of Unilateral Upper Limb Function Scale (MUUL). The novel finding is that AOT increases µ rhythm desynchronization at scalp locations corresponding to the hand representation areas. This effect is associated to functional improvement assessed with the MUUL. These preliminary findings, although referred to a small sample, suggest that AOT may affect upper limb motor recovery in children with CP and modulate the activation of sensorimotor areas, offering a potential neurophysiological correlate to support the clinical utility of AOT.

PMID: 31981294

3. Does Intrathecal Baclofen Therapy Increase Prevalence and/or Progression of Neuromuscular Scoliosis?
Walker KR, Novotny SA, Krach LE.


STUDY DESIGN: Retrospective, case-matched review. OBJECTIVES: Compare a group of individuals with cerebral palsy (CP) who had intrathecal baclofen (ITB) pumps to a group of individuals with CP who did not have ITB pumps in order to determine if there was a difference in the prevalence of new-onset neuromuscular scoliosis, an increased rate of progression of preexisting neuromuscular scoliosis, or an increased rate of posterior spine fusion surgery in skeletally immature individuals with CP who had ITB pumps. Various authors report conflicting findings, with some reporting an increased incidence or prevalence of scoliosis in individuals with CP who have ITB pumps whereas others report no difference in the rate of scoliosis between groups. METHODS: Retrospective chart and radiographic case-matched study in which individuals were matched by gender and Gross Motor Function Classification Scale (GMFCS) level. RESULTS: We found no difference in the rates of new-onset neuromuscular scoliosis for those with CP and ITB pumps and those without ITB pumps. However, we did see a higher rate of progression as well as an increased rate of posterior spine fusion surgery in individuals with CP who had ITB pumps than for those with CP who did not have an ITB pump. CONCLUSIONS: We continue to recommend ITB pump therapy for individuals with severe spasticity associated with CP (GMFCS IV and V). There is a significant risk of complications for individuals in general. The risk of neuromuscular scoliosis is relatively high in this population. Our findings suggest that individuals with CP who have ITB pumps and who do or do not have preexisting scoliosis should be monitored closely for either developing new neuromuscular scoliosis or progression of preexisting scoliosis.

PMID: 31997212


BACKGROUND: Series on the learning curve in spinal deformity surgery have been published, but none has addressed neuromuscular spinal deformity, comprised of arguably the most complex cases. We present the first multi-center analysis of the impact of surgeon experience on neuromuscular spinal deformity surgery. METHODS: A multi-center prospective study of spinal deformity surgery for cerebral palsy (CP) with at least 2 years of follow-up provided the dataset for assessment. Surgeons were categorized into one of two groups based on their self-reported first year of practice: an experienced surgeons (ES) group included those with at least 10 years of experience at the time of surgery and a young surgeons (YS) group included those with fewer than 10 years of experience at time of surgery. Groups were compared in multiple pre-operative, operative, and post-operative outcomes. RESULTS: The YS group had 8 surgeons who performed 59 surgeries; the ES group had 13 surgeons who performed 103 cases, with one surgeon's cases distributed in both groups. The YS group had a greater proportion of patients with severe mental retardation (89.7% vs. 68.6%, p = .01). Duration of surgery was greater in the YS group (456 vs. 344 minutes, p < .001). The mean number of levels fused was greater in the ES group (15.9 vs. 15.6, p = .024), caused by increased variation in the upper level of fusion among the ES group. No significant differences were found between groups for estimated blood loss, length of hospitalization, or in percentage of Cobb correction. Years of experience of the operating surgeon was inversely correlated with duration of surgery (rho = -0.476, p < .001). CONCLUSIONS: In performing scoliosis surgery on CP patients, surgeons with fewer than ten years of practice experience demonstrate significantly greater average operative time and decreased mean number of levels fused, yet produce similar clinical outcomes to more experienced surgeons. LEVEL OF EVIDENCE: Level III, therapeutic.

PMID: 31994122
Ramchandran S, George S, Asghar J, Shufflebarger H.


STUDY DESIGN: Single-center retrospective study. OBJECTIVE: To analyze two-year postoperative outcomes following spinopelvic fixation in pediatric patients using the anatomic trajectory (AT) portal for iliac screws. Iliac fixation is crucial in situations requiring fusion to sacrum. Challenges include complex anatomy, pelvic deformation, severe deformity, and previous surgery. The PSIS portal requires significant dissection, rod connectors, and complex bends. The SAI portal requires navigating the screw across the SI joint to the ilium. The anatomic trajectory (AT), first reported in 2009, is between the PSIS and SAI portal, without prominence, connectors, or complex bends. METHODS: Fifty-four patients aged ≤18 years requiring instrumentation to the Ilium with minimum follow-up of two years (mean 44 months) were clinically and radiographically evaluated. Changes in coronal curve magnitude and pelvic obliquity were assessed using paired t test for patients with cerebral palsy. Spondylolisthesis reduction was assessed in patients with moderate- to high-grade spondylolisthesis (Meyerding grade 3 and 4). RESULTS: A total of 108 iliac screws were inserted using AT portal in 54 patients. Twenty-eight neuromuscular and syndromic patients had an initial mean coronal curve of 85° corrected to 23° at two years (p < .001) and a pelvic obliquity of 22° corrected to 4° (p < .001). Twenty patients with moderate- to high-grade spondylolisthesis treated with reduction and interbody fixation improved significantly with respect to their slip angles (7° ± 14.7° to -7.9° ± 6.1°, p = .003). In the neuromuscular group, two surgical site infections occurred, two had implant fractures, and 12 had asymptomatic iliac screw loosening, none requiring revision. In the spondylolisthesis group, there were no neurologic complications and one had prominent screw requiring removal. Of 108 iliac screws, 2 rod connectors were employed. CONCLUSION: Iliac screw insertion using the AT portal is a safe and effective method of pelvic fixation in pediatric patients with satisfactory radiographic correction and minimal complications. LEVEL OF EVIDENCE: Level 4.

PMID: 31981170

Adams AJ, Refakis CA, Flynn JM, Pahys JM, Betz RR, Bastrom TP, Samdani AF, Brusalis CM, Sponseller PD, Cahill PJ.


STUDY DESIGN: Prospective multicenter comparative study. OBJECTIVES: We aimed 1) to survey surgeons and caregivers to rank the surgical indications for spinal fusion of pediatric patients with neuromuscular scoliosis secondary to cerebral palsy in order of importance and 2) to characterize the agreement of surgeons and caregivers on major (top three) indications. Surgery for spinal deformity in children with cerebral palsy is a multifaceted and individualized decision that may lead to miscommunication during informed consent. Little data exist on communication effectiveness between surgeon and caregiver during preoperative discussion. METHODS: This is a multicenter, prospective survey of Harms Study Group patient caregivers and their surgeons. Participants ranked their most important of 15 indications in descending level of importance, where the top 3 selections were considered major indications for surgery for the particular patient in question. Demographic and other perioperative factors were recorded. Surgeon-caregiver agreement on major indications was determined, taking into account preoperative factors and intersurgeon differences. RESULTS: 126 surgeon-caregiver pairs responded. The greatest percentage agreement that an indication was major was "to improve sitting" (69.0% major, 0.8% nonmajor), followed by "to prevent pulmonary compromise" (33.3% major, 24.6% nonmajor), "to improve pain" (31.7% major, 20.6% nonmajor), and "to improve head control/position" (20.7% major, 69.0% nonmajor). Preoperative pain showed an association with surgeon-caregiver agreement on pain as a major indication (p=.004), and intersurgeon differences in agreement on gastrointestinal and pain considerations existed (p=.002, p=.007, respectively). CONCLUSIONS: Surgeon-caregiver agreement is greater where literature support for a particular surgical indication is strong (ie, spinal fusion's known improvement of sitting posture in children with neuromuscular scoliosis). Stronger literature support may bolster surgeons' confidence in recommending a particular procedure, fostering greater communication, understanding, and agreement on surgical necessity between caregivers and surgeons. LEVEL OF EVIDENCE: Level II, prospective comparative study.

PMID: 31981167
7. Does an intrathecal baclofen pump impact scoliosis progression and complicate posterior spine fusion in patients with cerebral palsy?
Lins LAB, Nechyporenko AV, Halanski MA, Hetzel SJ, Noonan KJ.


STUDY DESIGN: Retrospective comparative study. OBJECTIVES: In patients with cerebral palsy (CP), we determine the impact of intrathecal baclofen pumps (ITBPs) on scoliosis curve progression before posterior spine fusion (PSF) and its effects on surgical outcome. BACKGROUND: Children with CP can have rapid scoliosis progression, and high rates of surgical complications can be encountered. It is unknown whether the presence of pre-existing ITBP results in more difficult surgery and higher complication rates in similarly affected children. METHODS: This is a single-center retrospective study of CP patients undergoing PSF over a 15-year period. Demographics, comorbidities, curve magnitudes, and surgical methods were compared between patients with ITBP and those without. Postoperative complications, length of intensive care unit/hospital stay, drain use and output volume, and need for further surgery were also compared. Curve progression analysis after ITBP placement was performed on a subgroup of patients with high-quality consistent radiographs. RESULTS: Nineteen patients with ITBP and 49 patients without ITBP met inclusion criteria. Age, comorbidities, number of levels fused, and fixation techniques during PSF were not significantly different between cohorts. ITBP patients were more likely to have PSF with osteotomy (p = 0.022). Increased intraoperative neurosurgical consultations were found for patients with ITBP (42.1% vs. 4.0%; p < 0.001). Median surgical time was 1.2 h greater in patients with ITBP (6.7 vs. 5.5 h, p = 0.039). There was no difference in hospital course and complications in patients with ITBP and those without ITBP. Thirty-one patients without ITBP were compared with 15 ITBP patients for curve progression before PSF, demonstrating a mean rate of scoliosis progression of 9.6° ± 6.7°/year and 14.8° ± 9.1°/year (p = 0.0346), respectively. CONCLUSION: The presence of an ITBP appears to be associated with the increase in scoliosis progression; and these patients will likely have a more challenging spine fusion. Fortunately, the final outcome is not affected by ITBP. LEVEL OF EVIDENCE: Level III.

PMID: 31981152


An increasing number of studies support the view that transcutaneous electrical stimulation of the spinal cord (TESS) promotes functional recovery in humans with spinal cord injury (SCI). However, the neural mechanisms contributing to these effects remain poorly understood. Here we examined motor evoked potentials in arm muscles elicited by cortical and subcortical stimulation of corticospinal axons before and after 20 min of TESS (30Hz pulses with a 5kHz carrier frequency) and sham-TESS applied between C5-C6 spinous processes in males and females with and without chronic incomplete cervical SCI. The amplitude of subcortical but not cortical motor evoked responses increased in proximal and distal arm muscles for 75 min after TESS, but not sham-TESS, in controls and SCI participants, suggesting a subcortical origin for these effects. Intracortical inhibition, elicited by paired stimuli, increased after TESS in both groups. When TESS was applied without the 5kHz carrier frequency both subcortical and cortical motor evoked responses were facilitated without changing intracortical inhibition, suggesting that the 5kHz carrier frequency contributed to the cortical inhibitory effects. Hand and arm function improved largely when TESS was used with, compared to without the 5kHz carrier frequency. These novel observations demonstrate that TESS influence cortical and spinal networks, having an excitatory effect at the spinal level and an inhibitory effect at the cortical level. We hypothesized that these parallel effects contribute to further the recovery of limb function following SCI.SIGNIFICANCE STATEMENTAccumulating evidence supports the view that transcutaneous electrical stimulation of the spinal cord (TESS) promotes recovery of function in humans with spinal cord injury (SCI). Here, we show that a single session of TESS over the cervical spinal cord in individuals with incomplete chronic cervical SCI influenced in parallel the excitability cortical and spinal networks, having an excitatory effect at the spinal level and an inhibitory effect at the cortical level. Importantly, these parallel physiological effects had an impact of the magnitude of improvements in voluntary motor output.

PMID: 31996455

Jain A, Modhia UM, Njoku DB, Shah SA, Newton PO, Marks MC, Bastrom TP, Miyanji F, Sponseller PD.
STUDY DESIGN: Retrospective review of prospective registry. OBJECTIVES: To assess the following in children with cerebral palsy (CP) who develop deep surgical site infection (DSSI) after spinal fusion: (1) rate of infection recurrence after treatment; (2) treatments used; (3) radiographic outcomes; and (4) differences in Caregiver Priorities and Child Health Index of Life with Disabilities (CPCHILD) scores versus those of children with no infection (NI). Studies show high rates of surgical site infection in patients with CP but do not address late recurrence or quality-of-life effects. METHODS: One hundred fifty-one children with CP underwent spinal fusion surgery from 2008 through 2011 and had ≥2-year follow-up. Patients who developed DSSI were compared with patients with NI. Student t tests were used to analyze deformity; analysis of variance was used to analyze CPCHILD scores in both groups preoperatively and at final follow-up. RESULTS: Eleven patients developed DSSI. Causative organisms were polymicrobial infection (5 cases), Escherichia coli (2 cases), and Proteus mirabilis, Staphylococcus aureus, Enterococcus faecalis, and Peptostreptococcus (1 case each). All patients underwent irrigation and debridement and received at least 6 weeks of antibiotics. Six had negative-pressure-dressing-assisted wound closure; 5 had primary closure. At mean 4-year follow-up (range, 3-5 years) no patient had recurrent infection. From immediate postoperative to final follow-up, no patient had significant loss of coronal curve (p = .77) or pelvic obliquity (p = .71) correction. However, at final follow-up, comfort and emotions, overall quality-of-life, and total CPCHILD scores in the DSSI group were significantly lower compared with the NI group (p = .005, .022, and .026, respectively). CONCLUSIONS: In children with CP who developed DSSI after spinal fusion, there was no recurrence of infection or deformity after infection treatment. CPCHILD scores in patients with DSSI were lower compared with the NI group.

PMID: 31994134


BACKGROUND: Human walking involves a rapid and powerful contraction of ankle plantar flexors during push-off in late stance. OBJECTIVE: Here we investigated whether impaired push-off force contributes to gait problems in children with cerebral palsy (CP) and whether it may be improved by intensive gait training. METHODS: Sixteen children with CP (6-15 years) and fourteen typically developing (TD) children (4-15 years) were recruited. Foot pressure was measured by insoles and gait kinematics were recorded by 3-dimensional video analysis during treadmill and overground walking. The peak derivative of ground reaction force at push off (dPF) was calculated from the foot pressure measurements. Maximal voluntary plantar flexion (MVC) was measured while seated. Measurements were performed before and after a control period and after 4 weeks of 30 minutes daily inclined treadmill training. RESULTS: dPF and MVC were significantly lower in children with CP on the most affected (MA) as compared to TD children (p < .001). dPF was lower on the MA leg as compared to the less affected (LA) leg in children with CP (p < .05). Following gait training, increases in dPF (p < .001) and MVC (p < .01) were observed for the MA leg. Following gait training children with CP showed similar timing of dPF and similar stance phase duration on both legs indicating improved symmetry of gait. These effects were also shown during overground walking. CONCLUSION: Impaired ability to voluntarily activate ankle plantar flexors and produce a rapid and powerful push-off during late stance are of importance for impaired gait function in children with CP. Intensive treadmill training may facilitate the drive to ankle plantar flexors and reduce gait asymmetry during both treadmill and overground walking.

PMID: 31989957

Philip SS, Guzzetta A, Chorna O, Gole G, Boyd RN.


BACKGROUND: Cerebral Visual Impairment (CVI) is very common yet often unrecognised visual dysfunction in children with Cerebral Palsy (CP). Magnetic Resonance Imaging (MRI) is the diagnostic tool in the investigation of brain lesions in children with CP and CVI. AIM: The aim of this systematic review is to evaluate the relationship between brain structure and CVI, as determined by MRI in children with CP. METHODS AND PROCEDURES: A comprehensive search of 5 database
(PubMed, EMBASE, SCOPUS, CINAHL and Cochrane Database) was undertaken up until June 2019. The PRISMA checklist was then utilised to report on the process of selecting eligible papers. A total of 30 observational studies met the full inclusion criteria. Further, STROBE checklist was employed to report on the observational studies. OUTCOMES AND RESULTS: Periventricular leucomalacia on MRI was found to have a strong association with CVI in all 30 studies. Only 13 (43 %) studies described dorsal and/ ventral stream dysfunction. There was ambiguity in the definition of CVI. CONCLUSIONS AND IMPLICATIONS: The overall level of evidence correlating different patterns of CVI and CP (based on GMFCS, motor type and distribution) and MRI was low. Further studies utilising advances in MRI are needed to understand brain reorganisation and patterns of CVI and suggest rehabilitation therapy inclusive of vision.

PMID: 32004872

12. Anxiety Disorders and Medical Comorbidity: Treatment Implications.
Meuret AE, Tunnell N, Roque A.


Anxiety disorders are debilitating psychological disorders characterized by a wide range of cognitive and somatic symptoms. Anxiety sufferers have a higher lifetime prevalence of various medical problems. Chronic medical conditions furthermore increase the likelihood of psychiatric disorders and overall dysfunction. Lifetime rates of cardiovascular, respiratory, gastrointestinal, and other medical problems are disproportionately high in anxiety and panic/fear sufferers. The heightened comorbidity is not surprising as many symptoms of anxiety and panic/fear mimic symptoms of medical conditions. Panic disorder specifically is strongly linked to medical conditions due to its salient somatic symptoms, such as dyspnea, dizziness, numbness, chest pain, and heart palpitations, all of which can signal danger and deterioration for chronic disease sufferers. This chapter identifies shared correlates of medical illness and anxiety disorders and evidence for misinterpretation of symptoms as medically relevant and offers an analysis of implications for treatment of both types of conditions. We will concentrate on medical conditions with high associations for anxiety and panic by aspects of symptomatology, specifically neurological disorders (fibromyalgia, epilepsy, cerebral palsy), diabetes, gastrointestinal illness (irritable bowel syndrome, gastroesophageal reflux disease), and cardiovascular and respiratory illnesses (asthma).

PMID: 32002933

13. Comparison of three therapeutic interventions for chronic constipation in paediatric patients with cerebral palsy: a randomised clinical trial.
Imanieh MH, Golpayegan MR, Sedighi M, Ahmadi K, Aghaie A, Dehghani SM, Yousefi G.


INTRODUCTION: Cerebral palsy (CP) is a permanent non-progressive movement disorder, which is due to brain injuries during brain development. Constipation is one of the prevalent conditions in children with CP that can adversely affect the psychological health, appetite, and overall health of these patients. AIM: To compare three therapeutic methods in the treatment of chronic constipation in CP children. MATERIAL AND METHODS: In this randomised clinical trial (RCT), paediatric CP patients with chronic constipation were randomly divided into three groups (groups A, B, and C). Group A received polyethylene glycol (PEG), group B received PEG with Motilium, and group C received Motilium for 2 weeks. Motilium was administered at 0.2 mg/kg/dose and PEG at 0.5 g/kg/dose three times daily. To compare the therapeutic effect the McNemar test was used and a significance level of 0.05 was considered. RESULTS: The highest rate of improvement in chronic constipation was seen in group B and the lowest rate belonged to group C. Satisfactory response frequency was seen in 10 patients in group A (58.8%), 17 patients in group B (94.4%), and 1 patient in group C (6.6%); p < 0.001. CONCLUSIONS: According to the findings, simultaneous use of PEG and Motilium had the best therapeutic effect for chronic constipation among CP children. However, Motilium alone was nearly ineffective, and PEG alone had a moderate therapeutic effect.

PMID: 31988677

14. Application of Magnetic Resonance Imaging Molecular Probe in the Study of Pluripotent Stem Cell-derived Neural
16. **Wearable electromyography recordings during daily life activities in children with cerebral palsy.**

Wang D, Bo Z, Lan T, Pan J, Cui D.


The paper studied the feasibility and efficacy of magnetic resonance imaging molecular probe application and pluripotent stem cell-derived neural stem cell transplantation for the treatment of hind limb paralysis in mice with cerebral infarction. This paper used adult mice as experimental objects to establish a model of middle cerebral artery infarction and stimulate hindlimb reactions. After the model was successfully established, the mice were first divided into an experimental group and a control group, with 25 mice in each group. Cultured neural cells were obtained from the cerebral cortex and hippocampus of a mouse 15 days pregnant to prepare pluripotent stem cells. Pluripotent stem cell-derived neural stem cells were identified by positive expression of nestin. The experimental group was injected with 1μL of neural stem cell suspension through the tail vein, and the control group was injected with 1μL of saline through the tail vein. 1 day, 3 days, 7 days, 14 days and 28 days after transplantation, the neurological function of mice in each group was scored according to Garcia 18 subscale. Finally, the differentiation, migration, and integration of pluripotent stem cell-derived neural stem cells after transplantation were observed using a magnetic resonance imaging molecular probe method. The results showed that the neurological function scores of the ischemic transplantation group were significantly higher than those of the control group, and the results were different, and the results were significantly different (P<0.05). Through research, it was found that after transplantation of pluripotent stem cell-derived neural stem cells, the transplanted cells migrated and differentiated around the body at 28 days, and participated in angiogenesis, and the blood vessels in the infarcted area were obviously proliferated. The neural stem cells cultured in vitro were transplanted to the small infarction after cerebral infarction. In rats, it plays a positive role in the repair of nerve function in mice with cerebral infarction. Neural stem cells cultured in vitro can survive, migrate and differentiate in the brain tissue of mouse ischemic models, and play a positive role in the repair of neurological function in mice with cerebral infarction. Magnetic resonance imaging molecular probes have a good adjuvant effect on the use of pluripotent stem cell-derived neural stem cells to treat hindlimb paralysis in mice with cerebral infarction.

PMID: 32001413

15. **Cranial MR characteristics of Cerebral Palsy cases and correlation of findings with clinical results.**

Ali A, Yalçın R, Ünlüer-Gümüştaş A.


The aim of this study was to compare cranial Magnetic Resonance (MR) imaging findings in cerebral palsy (CP) patients with clinical findings and evaluate damage ascribed to prenatal, natal and postnatal reasons by preterm, term or postterm characteristics. One thousand, one hundred CP patients registered at Dr. Ayten Bozkaya State Hospital of Cerebral Palsy Children and Rehabilitation Center from 2007 to 2010 were included in the study retrospectively. Cranial MR images studied in Bursa State Hospital Radiology Unit were evaluated by ‘a single senior MRI radiologist’. The most common abnormality was cerebral atrophy (80.2%) followed by periventricular leukomalacia (PVL) (49.9%). The most common type was spastic tetraplegia (67.9%), and the second most common type was hypotonic CP (15.6%). The percentage of congenital central nervous system (CNS) abnormality was 14.09%. The most common abnormality was corpus callosum (CC) agenesis and colpocephaly (2.3%). The least common conditions were cortical dysplasia, heterotopia and rhombencephalosynapsis. The percentage of cases born to consanguineous parents was 19.2%. In Hypoxic Ischemic Encephalopathy (HIE) patients born to consanguineous parents, PVL was cystic and moderate. Consanguineous marriage was statistically significant in the patients with cortical dysplasia and heterotopia (p < 0.04), delay in myelination (p < 0.001) and thalamus involvement (p < 0.008). Consanguineous marriage was also statistically significant in spastic diparetic (p < 0.017), hypotonic (p < 0.001) and bedridden patients (p < 0.006). The presence of both congenital CNS anomaly and PVL was only revealed in spastic tetraparetic type. Twenty-nine% of the cases were premature, while 66.4% were term children. Low birth weight (32.7%) constituted a risk factor for all clinical types, except mixed type CP. The percentage of patients with natal causes only was 21.5%. Kernicterus, cerebrovascular causes and HIE accounted for 6.3%, 2.9% and 54.4% of the cases, respectively. This study may indicate the importance of consanguineous marriage, natal and postnatal care properties as the underlying causes of CP beyond the clinical management related to delivery and allow us to identify strategies for possible measures.

PMID: 31990470

15. **Cranial MR characteristics of Cerebral Palsy cases and correlation of findings with clinical results.**

Ali A, Yalçın R, Ünlüer-Gümüştaş A.


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PMID: 31990470

16. **Wearable electromyography recordings during daily life activities in children with cerebral palsy.**
AIM: To test whether wearable textile electromyography (EMG) recording systems may detect differences in muscle activity levels during daily activities between children with cerebral palsy (CP) and age-matched typically developing children.

METHOD: Wearable textile EMG recording systems were used to obtain leg muscle activity in 10 children with spastic CP (four females, six males; mean age 9y 6mo, standard deviation [SD] 2y 4mo, range: 6-13y; Gross Motor Function Classification System [GMFCS] level I and II) and 11 typically developing children (four females, seven males; mean age 9y 9mo, SD 1y 11mo, 7-12y) at rest and while performing seven daily activities. RESULTS: Children with CP showed significantly lower absolute EMG levels during maximal voluntary contractions (MVCs) of muscles on the most affected side as compared to the least affected side and to typically developing children. None of the typically developing children or children with CP showed detectable EMG activity in resting situations. EMG activity relative to MVC was greater in children with CP during walking, jumping, and kicking on the most affected side as compared to the least affected side and to typically developing children. INTERPRETATION: Wearable textile EMG recording systems may be used to determine differences in muscle activity during daily activities in children with CP. Children with CP showed reduced muscle activity during daily activities compared to their peers, but used a significantly larger part of their maximal voluntary muscle strength to perform these activities. WHAT THIS PAPER ADDS: Wearable textile electromyography (EMG) systems are feasible for measurement of daily muscle activity in children with cerebral palsy (CP). Children with CP showed reduced EMG levels during maximal voluntary contractions. Neither typically developing children or children with CP showed EMG activity in resting situations. Children with CP used a larger part of their voluntary muscle strength during daily activities.

PMID: 31989593

17. Transition to adult care for young people with cerebral palsy.


Cerebral palsy (CP) is associated with a high burden of comorbid respiratory disease subsequent to multiple risk factors associated with increasing levels of disability. Correspondingly, respiratory disease is the leading cause of death in CP, including amongst young people who are transitioning or who have just transitioned between paediatric and adult healthcare services. Therefore, consideration of both preventive and therapeutic respiratory management is integral to transition in patients with CP, as summarised in this review.

PMID: 31987717

Farajzadeh A, Maroufizadeh S, Amini M.


AIM: To identify the factors pertaining to the quality of life (QOL) among the mothers of patients with cerebral palsy.

METHODS: In this cross-sectional study, 203 mothers of children with cerebral palsy were selected using convenience sampling. The World Health Organization's Quality of Life Questionnaire (WHOQOL-BREF), the Beck Depression Inventory, the Caregiver Difficulties Scale, Fatigue Severity Scale, and a demographic information questionnaire were administered to these caregivers. Hierarchical multiple linear regression analysis was used to detect the factors associated with QOL.

RESULTS: Moderate to high significant negative correlations were observed between all WHOQOL-BREF domains and the other measures. The demographic/clinical variables were controlled, and hierarchical multiple linear regression analysis was run. The results indicated that depression, the burden of care, fatigue, and the type of cerebral palsy could significantly predict QOL in these mothers. Furthermore, QOL was lower in the mothers of children with tetraplegia than those of children with other types of disabilities (P < .05). CONCLUSION: QOL of mothers of children with cerebral palsy is negatively impacted by various factors such as burden of care, fatigue, and psychological symptoms. Thus, a holistic approach, including training (carrying, positioning, feeding, and how to manage the self-care of children) and psychological interventions, is required to improve QOL among this population.
19. Gender differences in treatments and interventions received by children and adolescents with cerebral palsy. Lundkvist Josenby A, Czuba T, Alriksson-Schmidt A.


BACKGROUND: In the Swedish population-based follow-up program and national quality registry for individuals with cerebral palsy (CPUP), physiotherapy (PT) and occupational therapy (OT) treatments are regularly recorded along with functional status. By Swedish law, all citizens irrespective of personal characteristics or socioeconomic status, have the right to receive healthcare and medical treatments as applicable. Previous research has shown gender differences in treatments and interventions received by children with cerebral palsy (CP). The purpose of this study was to examine differences in treatments and interventions by gender and place of birth in children and adolescents participating in CPUP. METHODS: This was a cross-sectional registry study. Data from the latest PT (n = 2635) and OT assessment forms (n = 3480) in CPUP were extracted for individuals aged 0-17 years. Logistic regressions were used to assess the relationships between the outcome variables and gender and place of birth (including an interaction term gender X place of birth), adjusted for age, Gross Motor Function Classification System (GMFCS) levels and spasticity scores for PT interventions and Manual Ability Classification System (MACS) for OT interventions. RESULTS: Results are presented as odds ratios [95% confidence intervals] and p-values. Girls were significantly more likely to have spine braces than boys; 1.54 [1.07, 2.22] p < 0.05, a significant interaction with place of birth indicated fewer spine braces prescribed to children born outside of the Nordic countries; 0.20 [0.079, 0.53] p < 0.001. Girls were less likely to have undergone selective dorsal rhizotomy (SDR); 0.49 [0.25, 0.94] p < 0.05. Individuals born outside of the Nordic countries, were significantly less likely to have received intrathecal baclofen (ITB) 0.27 [0.074, 0.98] p < 0.05. CONCLUSIONS: Of the treatments prescribed, gender differences were observed for spine braces and having undergone SDR. A statistically significant difference based on place of birth was noted for spinal bracing and having received ITB treatment. Other PT and OT treatments were associated with age, level of spasticity, and functional severity as classified using the GMFCS and the MACS. Increased awareness of differences based on gender, and where a child is born, could be obtained by inter- and intraprofessional discussions.

PMID: 32000727


Objective: To investigate the clinical features and imaging characteristics of mitochondrial encephalopathy, lactic acidosis, and stroke-like episodes (MELAS). Methods: Seventeen patients with MELAS diagnosed in the Affiliated Hospital of Xuzhou Medical University from July 2014 to August 2018 were enrolled in this study and their clinical manifestations, imaging and histopathological features were retrospectively analysed. We also discussed and summarised the related literature. Results: All of the 12 patients had seizures; stroke-like episodes in 12 cases; audio-visual impairment in 12 cases; headache in six cases; dysplasia in four cases; mental retardation in three cases; ataxia in two cases. On cranial magnetic resonance (MR) scans, the most common manifestations were in temporal-occipital-parietal lobe, cortical or subcortical areas as well as frontal lobe, thalamus, and basal ganglia showing long or equal T1 signals, long T2 signals, and hyperintense or iso-intense diffusion-weighted imaging (DWI) signals accompanied by ventricular enlargement and brain atrophy. MR spectroscopy showed that lactic acid peaks could be found in lesion sites, normal brain tissues, and cerebrospinal fluid. Muscle biopsy and genetic testing are the gold standard for diagnosing MELAS, muscle biopsy revealed COX-negative muscle fibres and SDH-stained red ragged fibres (RRF) under the sarcolemma. Mutations of mtDNA A3243G locus were common on gene testing. Improvement of mitochondrial function was observed after symptomatic and supportive treatment. Conclusion: MELAS should be considered for patients with epileptic seizures, headache, stroke-like episodes, extraocular palsy, cognitive decline and other clinical manifestations with the lesion located in the temporal-occipital-parietal lobe regardless of the distribution of blood vessels, and further examinations including muscle biopsy and gene testing should be performed to confirm the diagnosis.

PMID: 32000557
Li D, Chen QX, Zou W, Sun XW, Yu XP, Dai XH, Teng W.


Acupuncture is widely used in the treatment of cerebral hemorrhage, and it improves outcomes in experimental animal models and patients. However, the mechanisms underlying the effectiveness of acupuncture treatment for cerebral hemorrhage are still unclear. In this study, a model of intracerebral hemorrhage was produced by injecting 50 μL autologous blood into the caudate nucleus in Wistar rats. Acupuncture at Baihui (DU20) and Qubin (GB7) acupoints was performed at a depth of 1.0 inch, 12 hours after blood injection, once every 24 hours. The needle was rotated at 200 r/min for 5 minutes. For each 30-minute session, needling at 200 r/min was performed for three sessions, each lasting 5 minutes. For the positive control group, at 6 hours, and 1, 2, 3 and 7 days after induction of hemorrhage, the rats were intraperitoneally injected with 1 mL aniracetam (0.75 mg/mL), three times a day. The Bederson behavioral test was used to assess palsy in the contralateral limbs. Western blot assay was used to examine the expression levels of Nestin and basic fibroblast growth factor in the basal ganglia. Immunohistochemistry was performed to count the number of Nestin- and glial cell line-derived neurotrophic factor-positive cells in the basal ganglia. Acupuncture effectively reduced hemorrhage and brain edema, elevated the expression levels of Nestin and basic fibroblast growth factor in the basal ganglia, and increased the number of Nestin- and glial cell line-derived neurotrophic factor-positive cells in the basal ganglia. Together, these findings suggest that acupuncture promotes functional recovery after cerebral hemorrhage by increasing the expression of neurotrophic factors. The study was approved by the Committee for Experimental Animals of Heilongjiang Medical Laboratory Animal Center (approval No. 2017061001) on June 10, 2017.

PMID: 31997816

22. Using umbilical cord blood for regenerative therapy: proof or promise?
Allan DS.

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The identification of non-hematopoietic progenitor cells in cord blood has spawned great interest in using cord blood cells for new indications in regenerative therapy. Many pre-clinical studies demonstrated improvement in reperfusion and markers of organ recovery using cord blood-derived cells in a range of animal models. Initial results heralded increasing clinical interest regarding the use of cord blood for regenerative therapy. Initial clinical studies were largely uncontrolled feasibility studies that were case series and reported on small numbers of patients. The emergence of controlled studies has been slower, although multiple controlled studies have been conducted in patients with cerebral palsy and type 1 diabetes. Heterogeneity in the cellular product, patients, study design and the timing of outcome measurements remain barriers to metaanalysis and a clearer understanding of efficacy. Controlled studies of modest size have been reported for a range of additional conditions. The conduct of controlled clinical trials to evaluate potential new uses of cord blood for regenerative therapy remains essential. None of the indications studied to date can be regarded as proven. Moreover, consistency in outcome reporting in terms of the instruments used and the time points for assessment after therapy are needed, including longer follow up of study participants. Frequent and careful evaluation of the evidence will allow cord blood banks, health care providers, and patients to assess potential new options in the use of cord blood for regenerative therapy. © AlphaMed Press 2020 SIGNIFICANCE STATEMENT: The conduct of controlled clinical trials to evaluate potential new uses of cord blood for regenerative therapy remains essential. None of the indications studied to date can be regarded as proven, based on guidelines from the International Society of Cellular Therapy. Moreover, consistency in outcome reporting is needed, including longer follow up of study participants. Frequent and careful evaluation of the evidence will allow cord blood banks, health care providers, and patients to evaluate potential new options in the use of cord blood for regenerative therapy.

PMID: 31995251

23. Assessing key clinical parameters before and after intraventricular hemorrhage in very preterm infants.
Intraventricular cerebral hemorrhage (IVH) is one of the most severe complications of premature birth, potentially leading to lifelong disability. The purpose of this paper is the assessment of the evolution of three of the most relevant parameters, before and after IVH: mean arterial pressure (MAP), arterial carbon dioxide pressure (pCO2), and cerebral blood flow (CBF). Clinical records of 254 preterm infants with a gestational age of 23-30 weeks, with and without a diagnosis of IVH, were reviewed for MAP and arterial pCO2 in the period up to 7 days before and 3 days after IVH or during the first 10 days of life in cases without IVH. Conclusion: A statistically significant increase in pCO2 and decrease in MAP in patients with IVH compared with those without were detected. Both the mean values and the mean absolute deviations of CBF were computed in this study, and the latter was significantly higher than in control group. High deviations of CBF, as well as hypercapnia and hypotension, are likely to contribute to the rupture of cerebral blood vessels in preterm infants, and consequently, to the development of IVH. What is Known: • The origin of IVH is multifactorial, but mean arterial pressure, carbon dioxide partial pressure, and cerebral blood flow are recognized as the most important parameters. • In premature infants, the autoregulation mechanisms are still underdeveloped and cannot compensate for cerebral blood flow fluctuations. What is New: • The numerical simulation of CBF is shown to be a promising approach that may be useful in the care of preterm infants. • The mean values of CBF before and after IVH in the affected group were similar to those in the control group, but the mean absolute deviations of CBF in the affected group before and after IVH were significantly higher than that in the control group.

PMID: 31993776

Prevention and Cure

Prevention and cure
24. Mesenchymal stem cells and cerebral palsy.
Lee FK, Lin Y, Wang P.


PMID: 31985567