

Monday 5 November 2018

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## Interventions and Management

### 1. The use of pediatric locked plates in the paralytic hip: preliminary results of 61 cases.

Vallim FCM, Cruz HAD, Rodrigues RC, Abreu CSG, Godoy EDP, Cunha MG.

Rev Bras Ortop. 2018 Oct 10;53(6):674-680. doi: 10.1016/j.rboe.2017.09.009. eCollection 2018 Nov-Dec.

**OBJECTIVE:** To evaluate the clinical and radiologic results of proximal femoral varus derotational and shortening osteotomy (OVRF) (Port., doesn't match name) with the use of a locked plate in patients with cerebral palsy, classified by the gross motor functional classification system as class IV or V. **METHODS:** A retrospective study of 42 patients (61 hips) with cerebral palsy, gross motor functional classification system class IV or V, submitted to OVRF. The minimal follow up was 24 months. This study evaluated clinical (age at surgery, gender, Gross Motor Functional Classification System class, anatomical cerebral palsy classification, and motor pattern), pre- and post-operative radiological (neck shaft angle, acetabular index, Reimers migration index and time until bone healing) characteristics, as well as post-operative complications. **RESULTS:** Mean pre-operative cervicodiaphyseal angle, acetabular index, and Reimers migration index were respectively 121.6°, 22.7°, and 65.4% in uncomplicated cases, and 154.7°, 20.4°, and 81.1% in complicated ones. All parameters were statistically significant difference between pre- and postoperative values ( $p < 0.05$ ). The patients with postoperative complications had a greater cervicodiaphyseal angle and Reimers migration index ( $p < 0.0001$ ). There were no differences in clinical characteristics, time of immobilization, or bone healing. Fourteen patients had postoperative complications (33.3%), but only six required surgical treatment. **CONCLUSION:** The locked plate is a safe resource, with low complication rates and reproducible technique for OVRF in the cerebral palsy population classified as gross motor functional classification system IV and V. Greater cervicodiaphyseal angles and Reimers migration index are associated with greater chances of postoperative complications, as well as gross motor functional classification system V classification.

PMID: [30377599](#)

### 2. Effect of Horizontal Whole-Body Vibration Training on Trunk and Lower-Extremity Muscle Tone and Activation, Balance, and Gait in a Child with Cerebral Palsy.

Song S, Lee K, Jung S, Park S, Cho H, Lee G.

Am J Case Rep. 2018 Oct 31;19:1292-1300. doi: 10.12659/AJCR.910468.

**BACKGROUND** The aim of the present study was to investigate the effect of horizontal whole-body vibration (WBV) training on trunk and lower-extremity muscle tone and activation, balance, and gait in a child with spastic diplegia cerebral palsy. **CASE REPORT** A 10-year-old male with spastic diplegia cerebral palsy received horizontal WBV training followed by conventional physiotherapy (50 min per day, 12 days per month), but only conventional physiotherapy during followup. Muscle tone was assessed using the Modified Ashworth Scale (MAS) and muscle activation with surface electromyography. Balance was assessed using the Timed Up and Go test (TUG) and Pediatric Balance Scale (PBS), and gait parameters were

assessed using the GAITRite system. Assessment was performed at 3 points: pre-intervention, post-intervention, and follow-up. Following the intervention, MAS decreased in both the hip extensor and right ankle plantar flexor. Muscle activation increased post-intervention in the bilateral erector spinae (ES), rectus abdominis (RA), rectus femoris (RF), and right tibialis anterior (TA) during standing, and in the left RA, bilateral RF, gastrocnemius (GCM), and left TA during squatting. At follow-up, activation increased in the right ES, left RA, and RF during standing. At post-intervention and follow-up, improvement was observed in PBS score, gait velocity, right step length, and right stride length, with decreased single-leg support time, and double support and toe deviation angle. **CONCLUSIONS** Horizontal WBV training can safely and effectively maintain and improve physical performance and can be considered for inclusion in rehabilitation programs.

PMID: [30377290](#)

### **3. Single-Event Multilevel Surgery to Correct Movement Disorders in Children with Cerebral Palsy.**

Wick JM, Feng J, Raney E, Aiona M.

AORN J. 2018 Nov;108(5):516-531. doi: 10.1002/aorn.12402.

Cerebral palsy (CP) is a common motor disability that may be congenital or acquired. Children with CP often have gait, balance, and posture abnormalities, some of which may be severe enough to interfere with safe ambulation or other activities of daily living. Nonsurgical and surgical interventions are part of the management plan for children with CP. Historically, surgeons addressed gait deviations individually and sequentially with single-level surgeries. However, computerized motion analysis and advances in orthopedic internal fixation devices have improved the outcomes for patients undergoing single-event multilevel surgery. This article provides perioperative RNs with a basic understanding of movement disorders that can be corrected with single-event multilevel surgery, the role of computerized motion analysis in making treatment decisions for ambulatory pediatric orthopedic patients with CP, and various treatment options for the movement disorders of children with CP.

PMID: [30376177](#)

### **4. The Beneficial Effects of Massage on Motor Development and Sensory Processing in Young Children with Developmental Delay: A Randomized Control Trial Study.**

Lu WP, Tsai WH, Lin LY, Hong RB, Hwang YS.

Dev Neurorehabil. 2018 Oct 30:1-9. doi: 10.1080/17518423.2018.1537317. [Epub ahead of print]

**PURPOSE:** We investigated the effects of massage on young children with developmental delay but no clear diagnosis (e.g., cerebral palsy, genetic diseases, or autism). **METHODS:** Thirty-six children with DD, at 1-3 years of age, were randomly assigned to the massage (n = 18) or control group (n = 18) after being stratified by age and motor developmental quotient. The two groups continued to receive routine rehabilitation intervention, whereas the massage group additionally received 20 min of massage twice a week for 12 weeks. The Comprehensive Development Inventory for Infants and Toddlers - Diagnostic Test, the Infant/Toddler Sensory Profile - Chinese version, anthropometric measures, and a sleep questionnaire were administered before and after the massage intervention. **RESULTS:** The results of analysis of covariance revealed that the massage group exhibited a greater improvement in the total motor score (p = 0.023), gross motor score (p = 0.047), and sensory sensitivity behavior (p = 0.042). **CONCLUSION:** These findings suggest that massage can effectively enhance motor and sensory processing in children with DD.

PMID: [30376388](#)

### **5. Management of pain in children and adolescents with cerebral palsy: a systematic review.**

Ostojic K, Paget SP, Morrow AM.

Dev Med Child Neurol. 2018 Oct 31. doi: 10.1111/dmcn.14088. [Epub ahead of print]

**AIM:** To determine the efficacy of interventions for the management of pain in children and adolescents with cerebral palsy (CP). **METHOD:** Electronic databases were searched from the earliest date possible to April 2018 using a mixture of subject headings and free text. Inclusion criteria comprised of studies with (1) diagnosis of CP, (2) under the age of 18 years, (3)

intervention for the management of pain, (4) outcome measure of pain, and (5) studies published in English-language peer-reviewed journals. RESULTS: Fifty-seven studies met the eligibility criteria. Pain related to (n=number of studies): hypertonia (n=17), spastic hip disease (n=13), procedures for the management of CP (n=7), postoperative (n=18), and other (n=2). Most of the studies were of level III to level V evidence. INTERPRETATION: There is level II evidence to support intrathecal baclofen therapy for pain secondary to hypertonia in spastic and spastic-dyskinetic CP, and non-pharmacological interventions for procedural pain and pharmacological interventions for postoperative pain. Most studies were restricted by retrospective design and limited use of validated outcome measures. Future research is needed to explore multidisciplinary interventions for chronic pain and pain secondary to dystonia. Clinicians and researchers would benefit from a standardized approach to pain assessment. WHAT THIS PAPER ADDS: The strongest evidence exists for pharmacological treatments for postoperative pain in children and adolescents with cerebral palsy (CP). There is moderate evidence for the efficacy of intrathecal baclofen for pain related to hypertonia in predominately spastic CP. There is a lack of standardization in the assessment of pain. There is limited evidence for multimodal and non-pharmacological strategies in paediatric CP.

PMID: [30378122](#)

## 6. Symptomatic seizures in preterm newborns: a review on clinical features and prognosis.

Spagnoli C, Falsaperla R, Deolmi M, Corsello G, Pisani F.

Ital J Pediatr. 2018 Nov 1;44(1):115. doi: 10.1186/s13052-018-0573-y.

Neonatal seizures are the most common neurological event in newborns, showing higher prevalence in preterm than in full-term infants. In the majority of cases they represent acute symptomatic phenomena, the main etiologies being intraventricular haemorrhage, hypoxic-ischemic encephalopathy, central nervous system infections and transient metabolic derangements. Current definition of neonatal seizures requires detection of paroxysmal EEG-changes, and in preterm newborns the incidence of electrographic-only seizures seems to be particularly high, further stressing the crucial role of electroencephalogram monitoring in this population. Imaging work-up includes an integration of serial cranial ultrasound and brain magnetic resonance at term-equivalent age. Unfavourable outcomes following seizures in preterm infants include death, neurodevelopmental impairment, epilepsy, cerebral palsy, hearing and visual impairment. As experimental evidence suggests a detrimental role of seizures per se in determining subsequent outcome, they should be promptly treated with the aim to reduce seizure burden and long-term disabilities. However, neonatal seizures show low response to conventional anticonvulsant drugs, and this is even more evident in preterm newborns, due to intrinsic developmental factors. As a consequence, as literature does not provide any specific guidelines, due to the lack of robust evidence, off-label medications are often administered in clinical practice.

PMID: [30382869](#)

## 7. The Placenta in Neonatal Encephalopathy: A Case-Control Study.

Vik T, Redline R, Nelson KB, Bjellmo S, Vogt C, Ng P, Strand KM, Nu TNT, Oskoui M.

J Pediatr. 2018 Nov;202:77-85.e3. doi: 10.1016/j.jpeds.2018.06.005. Epub 2018 Jun 29.

OBJECTIVE: We assessed whether specific histologic placental lesions were associated with risk for neonatal encephalopathy, a strong predictor of death or cerebral palsy. STUDY DESIGN: Case-control study of singletons with gestational ages  $\geq 35$  weeks. Data were abstracted from a prospectively collected database of consecutive births at a hospital in which placental samples from specified sites are collected and stored for all inborn infants. Placentas of infants with neonatal encephalopathy were compared with randomly selected control infants (ratio of 1:3). Placental histologic slides were read by a single experienced perinatal pathologist unaware of case status, using internationally recommended definitions and terminology. Findings were grouped into inflammatory, maternal, or fetal vascular malperfusion (FVM) and other lesions. RESULTS: Placental samples were available for 73 of 87 (84%) cases and 253 of 261 (97%) controls. Delivery complications and gross placental abnormalities were more common in cases, of whom 4 died. Inflammation and maternal vascular malperfusion did not differ, and findings consistent with global FVM were more frequent in case (20%) than control (7%) placentas ( $P = .001$ ). There was a trend toward more segmental FVM and high-grade FVM (fetal thrombotic vasculopathy) among cases. Some type of FVM was observed in 24% of placentas with neonatal encephalopathy. In infants with both neonatal encephalopathy and placental FVM, more often than in infants with neonatal encephalopathy without FVM, electronic fetal monitoring tracings were considered possibly or definitely abnormal ( $P = .028$ ). CONCLUSIONS: Vascular malperfusion of subacute or chronic origin on the fetal side of the placenta was associated with increased risk of neonatal encephalopathy.

PMID: [30369428](#)

## 8. Preterm Birth and the Risk of Neurodevelopmental Disorders - Is There a Role for Epigenetic Dysregulation?

Fitzgerald E, Boardman JP, Drake AJ.

Curr Genomics. 2018 Nov;19(7):507-521. doi: 10.2174/1389202919666171229144807.

Preterm Birth (PTB) accounts for approximately 11% of all births worldwide each year and is a profound physiological stressor in early life. The burden of neuropsychiatric and developmental impairment is high, with severity and prevalence correlated with gestational age at delivery. PTB is a major risk factor for the development of cerebral palsy, lower educational attainment and deficits in cognitive functioning, and individuals born preterm have higher rates of schizophrenia, autistic spectrum disorder and attention deficit/hyperactivity disorder. Factors such as gestational age at birth, systemic inflammation, respiratory morbidity, sub-optimal nutrition, and genetic vulnerability are associated with poor outcome after preterm birth, but the mechanisms linking these factors to adverse long term outcome are poorly understood. One potential mechanism linking PTB with neurodevelopmental effects is changes in the epigenome. Epigenetic processes can be defined as those leading to altered gene expression in the absence of a change in the underlying DNA sequence and include DNA methylation/hydroxymethylation and histone modifications. Such epigenetic modifications may be susceptible to environmental stimuli, and changes may persist long after the stimulus has ceased, providing a mechanism to explain the long-term consequences of acute exposures in early life. Many factors such as inflammation, fluctuating oxygenation and excitotoxicity which are known factors in PTB related brain injury, have also been implicated in epigenetic dysfunction. In this review, we will discuss the potential role of epigenetic dysregulation in mediating the effects of PTB on neurodevelopmental outcome, with specific emphasis on DNA methylation and the  $\alpha$ -ketoglutarate dependent dioxygenase family of enzymes.

PMID: [30386170](#)

## Prevention and Cure

### 9. A New Approach to Cerebral Palsy Treatment: Discussion of the Effective Components of Umbilical Cord Blood and its Mechanisms of Action.

Jiao Y, Li XY, Liu J.

Cell Transplant. 2018 Nov 1;963689718809658. doi: 10.1177/0963689718809658. [Epub ahead of print]

Cerebral palsy (CP) includes a group of persistent non-progressive disorders affecting movement, muscle tone, and/or posture. The total economic loss during the life-span of an individual with CP places a heavy financial burden on such patients and their families worldwide; however, a complete cure is still lacking. Umbilical cord blood (UCB)-based interventions are emerging as a scientifically plausible treatment and possible cure for CP. Stem cells have been used in many experimental CP animal models and achieved good results. Compared with other types of stem cells, those from UCB have advantages in terms of treatment safety and efficacy, ethics, non-neoplastic proliferation, accessibility, ease of preservation, and regulation of immune responses, based on findings in animal models and clinical trials. Currently, the use of UCB-based interventions for CP is limited as the components of UCB are complex and possess different therapeutic mechanisms. These can be categorized by three aspects: homing and neuroregeneration, trophic factor secretion, and neuroprotective effects. Our review summarizes the features of active components of UCB and their therapeutic mechanism of action. This review highlights current research findings and clinical evidence regarding UCB that contribute to treatment suggestions, inform decision-making for therapeutic interventions, and help to direct future research.

PMID: [30384766](#)

### 10. The optimal choices of animal models of white matter injury.

Zeng Y, Wang H, Zhang L, Tang J, Shi J, Xiao D, Qu Y, Mu D.

Rev Neurosci. 2018 Oct 31. pii: /j/revneuro.ahead-of-print/revneuro-2018-0044/revneuro-2018-0044.xml. doi: 10.1515/revneuro-2018-0044. [Epub ahead of print]

White matter injury, the most common neurological injury in preterm infants, is a major cause of chronic neurological morbidity, including cerebral palsy. Although there has been great progress in the study of the mechanism of white matter injury in newborn infants, its pathogenesis is not entirely clear, and further treatment approaches are required. Animal models

are the basis of study in pathogenesis, treatment, and prognosis of white matter injury in preterm infants. Various species have been used to establish white matter injury models, including rodents, rabbits, sheep, and non-human primates. Small animal models allow cost-effective investigation of molecular and cellular mechanisms, while large animal models are particularly attractive for pathophysiological and clinical-translational studies. This review focuses on the features of commonly used white matter injury animal models, including their modelling methods, advantages, and limitations, and addresses some clinically relevant animal models that allow reproduction of the insults associated with clinical conditions that contribute to white matter injury in human infants.

PMID: [30379639](#)

### **11. The phosphodiesterase-4 inhibitor Rolipram promotes cognitive function recovery in prenatal *Escherichia coli* infected offspring.**

Zhu T, Yuan T, Yu H, Gu W, Chen X, Jiang P.

J Matern Fetal Neonatal Med. 2018 Oct 29;1-181. doi: 10.1080/14767058.2018.1542682. [Epub ahead of print]

**OBJECTIVE:** Preterm infants are especially vulnerable to intrauterine infection-induced brain injury, which is closely relevant with cognitive deficits and cerebral palsy. Rolipram, a phosphodiesterase-4 inhibitor, can improve cognition in rodents. However, the underlying roles and mechanisms are not well investigated. **METHODS:** In the present study, we used intrauterine *Escherichia coli* ( *E. coli* ) infected model. *E. coli* was inoculated into pregnant rats' uterine cervix at embryonic day 15 (E15) while the control group was given normal saline. Rolipram was administered by intraperitoneal (i.p.) injection once daily from postnatal day (P) 1-7. Morris water maze test was used for cognitive behavior test. Hippocampal neural stem/precursor cells (NSPCs) proliferation and neuronal differentiation were studied by immunofluorescent staining. The expressions of p-CREB, p-Akt, TrkB and BDNF were estimated by western-blot analysis. **RESULTS:** The data showed that Rolipram could ameliorate cognitive deficits and enhance NSPCs proliferation and neuronal differentiation in intrauterine infected offspring. Additionally, Rolipram could significantly increase p-CREB/CREB, p-Akt/Akt, TrkB and BDNF levels. **CONCLUSIONS:** These results suggested that Rolipram might play a neuroprotective role to promote cognitive function recovery after intrauterine infection. And hippocampal NSPCs proliferation and neuronal differentiation might be enhanced via CREB/Akt/BDNF signal transduction.

PMID: [30373424](#)